ENGINEERS ON THE TWIN RIVERS

ESSAYONS

A HISTORY OF THE U.S. ARMY ENGINEERS

NASHVILLE DISTRICT 1769-1978

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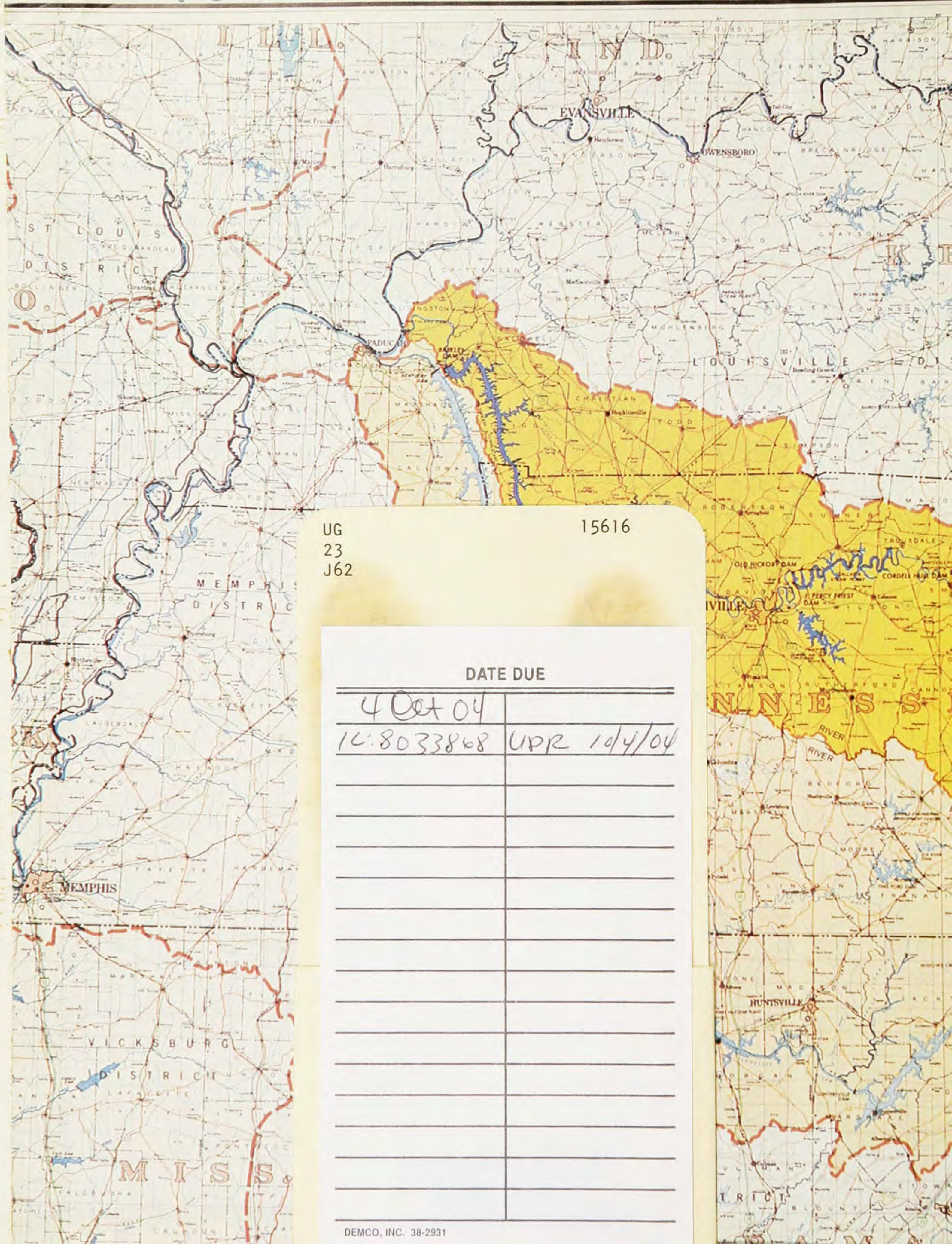

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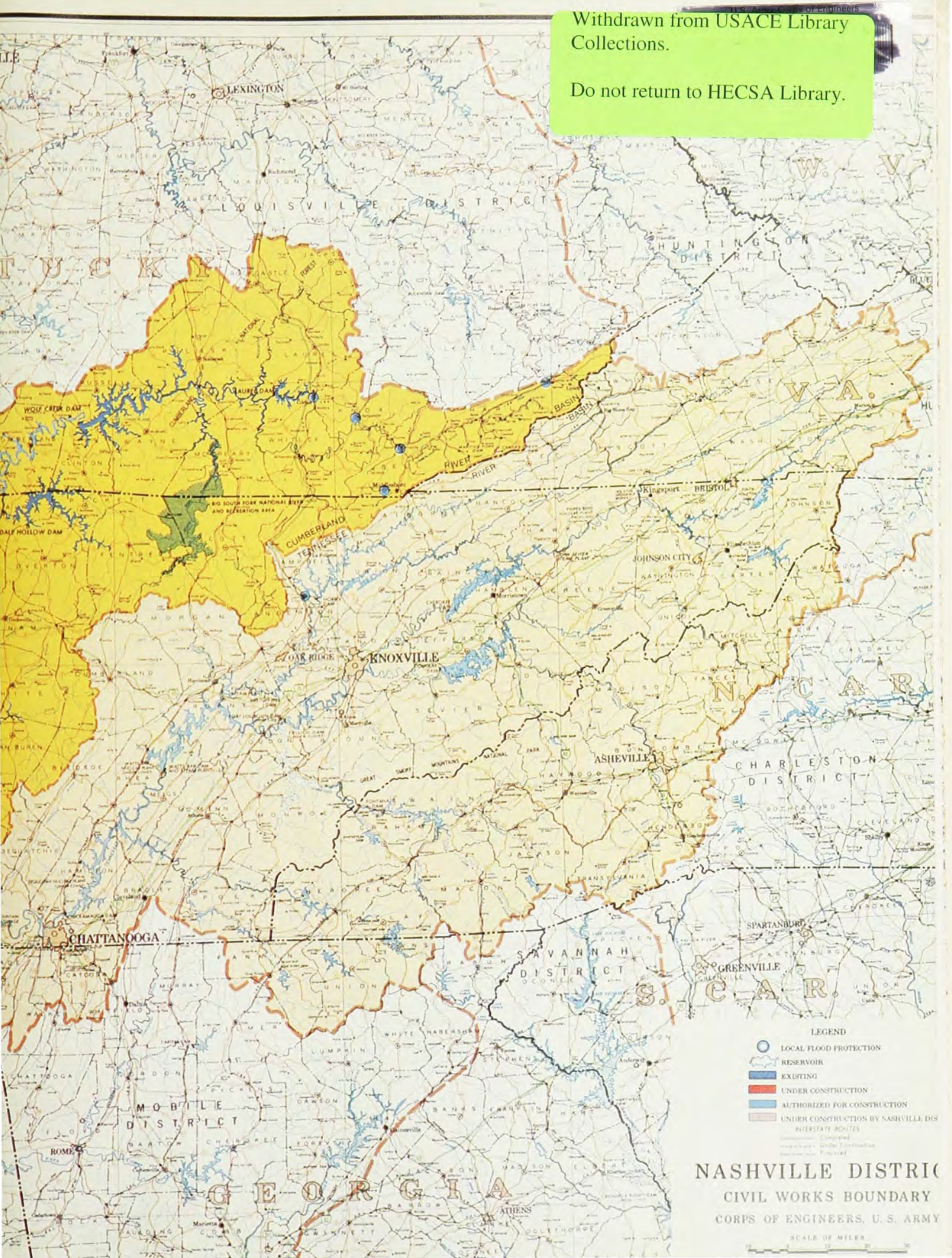
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TENNESSEE RIVER BASIN
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JOHNSON CITY
OAK RIDGE
KNOXVILLE
ASHEVILLE
GREAT SMOKY MOUNTAINS NATIONAL PARK
N. C. A. R.
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CHATTANOOGA
SAVANNAH DISTRICT
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ENGINEERS
ON THE
TWIN RIVERS

A HISTORY OF THE

NASHVILLE DISTRICT

CORPS OF ENGINEERS

UNITED STATES ARMY

BY
LELAND R. JOHNSON

DESIGN & ILLUSTRATIONS
BY
JAMES A. CRUTCHFIELD

U. S. ARMY ENGINEER DISTRICT — NASHVILLE
1978

PREFACE

The Corps of Engineers, United States Army has conducted operations directed toward the improvement of navigation and the comprehensive development of water resources on the twin rivers, the Cumberland and Tennessee, for nearly two centuries. When Lieutenant Thomas Hutchins, British Army Engineer, first mapped the twin rivers in 1769, they were wild, fluctuating streams, cascading mountain torrents in the upper reaches of their mountain tributaries in Kentucky, Virginia, North Carolina, Georgia, and East Tennessee, settling smoothly into lower gradients as they arced south across Middle Tennessee and North Alabama, and broadening as they swept north across western Tennessee and Kentucky to join with the Ohio River. Both rivers were tortuous, boulder-littered, snag-studded channels broken by serious obstructions to navigation, the Cumberland at Smith's and Harpeth Shoals, the Tennessee at the Narrows and at Muscle Shoals, but the pioneers of the region navigated the streams, nevertheless, in canoes, flatboats, keelboats, and other craft, creating a commerce vital to the economic development of the twin valleys. This early commerce brought the Army Engineers to the valleys, and their work, in less than two centuries, transformed the valleys.

The pioneers of the twin valleys recognized at an early date the need for improving navigation on their two avenues of commerce, and private corporations and state governments made some efforts to accomplish this task in the early nineteenth century. The national government also recognized this need and directed the Army Engineers to begin improvement of navigable waterways in 1824. The improvement of navigation on the Cumberland River began in 1832 and surveys for improvement of the Tennessee were made in the same year. In addition to improving twin river navigation, the Army Engineers also surveyed many canal routes designed to open new outlets for the commerce of the twin valley region to the Gulf of Mexico and the Atlantic Ocean. This early work laid the foundation for the continuous program of waterways improvement launched after the Civil War, which in turn led to the flood control program begun in 1936 and eventually to the comprehensive development of water resources in the twin basins.

The Corps of Engineers has, in addition to its water resources or civil works mission, a military mission, but military construction has been of secondary importance in the twin valleys, with the exceptions of the Civil War, when both Confederate and Union Army Engineers conducted combat engineering operations, and after 1940, when the Nashville Engineer District constructed many major military installations. And the Corps, over its two-century history, has performed many other missions: mapping and topographic work, railroad and canal surveys and construction, public buildings projects, civil defence support operations, and flood relief and disaster assistance work. The metamorphosis which has resulted from Army Engineer operations in the twin valleys has been revolutionary.

The Corps of Engineers has been known to the public by many titles during its history—the Army Engineers, United

States Engineers, the United States Engineer Department, or merely the Engineers—and the names have been used interchangeably in the records, as they will be herein, but each has slightly differing connotations and Corps of Engineers is the preferred modern usage. The modern Corps of Engineers is also an amalgamation of several other agencies: the Topographical Bureau, founded in 1813, was merged with the Corps of Engineers in 1863, and the Construction Division of the Quartermaster Corps was consolidated with the Corps of Engineers in 1941.

The Corps of Engineers administrative organization in the twin valleys has also been complex. The Corps civil works organization was composed of administrative districts corresponding in general to major river basins and coastal areas in 1975, and the Nashville Engineer District was responsible for Engineer operations in the Cumberland and Tennessee valleys, but from 1871 to 1933 the Chattanooga Engineer District was responsible for the Tennessee Valley and twice (1891-1895; 1918-1928) special Engineer Districts at Florence, Alabama, had charge of the work at Muscle Shoals on Tennessee River. Special Engineer Districts also existed at Oak Ridge, Kingsport, and Tullahoma, Tennessee, during the Second World War and afterwards for the administration of major military construction projects.

The history of the work of the Corps of Engineers, long neglected by historians, merits much greater attention because of the revolutionary effect it has had and is having on the quality of American life. With few significant exceptions, the sources of information about Engineer operations are exclusively primary, found chiefly in government documents, Engineer records in the National Archives, and voluminous but scattered records maintained in local Engineer offices. Except publications in technical journals by Engineer officers and personnel, the activities of the Nashville Engineer District and its predecessors have received little historical attention. This history seeks to remedy the problem of historical neglect and establish a foundation from which more detailed and perceptive historical analysis of the multifaceted and revolutionary work of the Army Engineers may proceed.

The author must express his gratitude to the late Samuel A. Weakley, pioneer student of Nashville District history, who personally recounted many vivid memories; Wilbur F. Creighton, Jr., who permitted use of family papers and the records of Foster-Creighton Company, the staffs of the Joint University Libraries of Nashville, the Nashville Public Library, the Tennessee State Library and Archives, who located many valuable sources; the staff of the Old Military Records Division, National Archives, who guided the author through the intricacies of Record Group 77; and Professor Harold W. Bradley of Vanderbilt University whose criticisms and guidance largely contributed to any merit this volume may have.

Special appreciation must be expressed to Dr. Jesse A. Remington, Chief, Engineer Historical Division, OCE, for his unflagging interest and advice, and to each member of the Historical Committee of the Nashville Engineer District whose constructive criticisms were important correctives. The interest and efforts of Reid Bethurum, Jr., Les Randles, Bill Darden, and Clyde Wisner, chairmen of the Historical Committee at various times, were vital to the completion of this project.

Some wag once said an engineer is a man who shoots the bull, passes the buck, and keeps three copies of everything. The author found not a particle of truth in the quip, except the "three copies," without which the production of this history would have been nearly impossible. Engineer personnel throughout the Nashville Engineer District have been, without exception, cooperative in this endeavor, and the author will be eternally grateful. He has never known a more dedicated and professional group of men and women.

Leland R. Johnson

FOREWORD

An understanding of the history and heritage of any organized human endeavor can provide an important appreciation for the past, present, and future roles of that endeavor in society. So this historical review of the efforts and contributions of the Army Engineers on the Cumberland and Tennessee rivers over two centuries provides a context for the role of the U. S. Army Corps of Engineers in this part of America.

The history of the Army Engineers in the Cumberland and Tennessee River basins since the late 1700's includes missions ranging from frontier exploration and mapping to emergency military construction during America's major wars; and from primitive open-channel work to canals and canalization projects to modern navigation, flood control and multipurpose projects.

The U. S. Army Corps of Engineers and its Nashville District have had an important role throughout these two centuries in which the Cumberland and Tennessee River basins have evolved—from frontier to predominantly agrarian to a balanced industrial-agrarian society. From exploration and the first efforts to make rivers more navigable to pioneering canal and canalization projects to the modern era, the work of the Army Engineers has had far-reaching impact upon regional development. One purpose of this history is to cast new light upon the significance of these contributions.

The full historic range of the projects and operations of the Nashville Engineer District and their impact upon life in the Cumberland and Tennessee river basins have never before been studied. The daily work of the District has been so pressing that we seldom find time to reflect upon the many missions of the District in their historical perspective. This volume is designed to fill that need for District personnel. We hope also that it will inform and interest the public.

Yet, this attempt to compress into a single volume the history of Engineer performance during two centuries allows only passing mention of many of the accomplishments by people of the District. The Nashville Engineer District has been a human institution responsive to human needs. Its history is therefore intrinsically human, with all the turbulence, adventure and humor which that implies. Limitations of space unfortunately prevented mention of most of the thousands of dedicated men and women who have devoted their lives to public service as employees of the Nashville District, for their names alone would fill a second volume. This is the collective story, however, of our efforts and hopes; our successes and failures; and our sacrifices.

Robert K. Tener
Colonel, U.S. Army
Corps of Engineers

CONTENTS


JIM SPEAR

CHAPTER I

EARLY TWIN RIVER NAVIGATION

Foaming rapids gurgled spitefully around the bow of the gunboat as the soldiers bent over the oars and drove it upstream between the precipitous limestone bluffs and alluvial bottoms of the river. Once past the silvery spray of the shoals, it slipped smoothly across green, still pools, but lurking beneath the surface were hidden snags and submerged boulders ready to rip the bottom from the soldiers' galley.

From the crags projecting over the sinuous river channel, mystified eyes gazed down on the strange craft with a brass cannon shining on its forecastle. It was 1769, a few years before the American Revolution and a decade before the pioneer bands led by James Robertson and John Donelson made their epic journey down the Tennessee and up the Cumberland to settle in Middle Tennessee, and already the Army Engineers had come to the twin valleys, the Cumberland and Tennessee rivers, in the person of Lieutenant Thomas Hutchins, Engineer of the British Army.

In the years since the first European colonists began their great adventure on the continent of North America, rivers had served as the principal highways and arteries of colonial commerce, just as they had for milleniums before in Europe and Asia and as they had for the American Indians. The colonists discovered a vast forest blanketing the New World, broken only by sparkling rivers, which they naturally followed on their inexorable westward march, forcing up the rivers to the headwaters and crossing the Appalachian Mountains into green river valleys, the inland waterways system, on their way toward the sunset.

By 1769, the rugged "long hunters," forerunners of a great migration, had crossed the Appalachians and were in the Cumberland and Tennessee river basins in force; Kasper Mansker, Abram Bledsoe, Joseph Drake, Uriah Stone were a few members of these bands of hunters and adventurers, while Daniel Boone, the renowned frontiersman, explored the wilds of the Upper Cumberland Valley alone. From the opposite direction, hunters came up the twin rivers from the Illinois country, led by Joseph Hollingshead, an agent of a Philadelphia mercantile house, to hunt the plentiful buffalo and deer in the twin valleys for sale to the British Army garrison at Fort Chartres and Kaskaskia in Illinois.[1]

The hunters were joined by an Army Engineer, Lieutenant Thomas Hutchins, the first Engineer to examine and map the topography and hydrology of the twin valleys, in command of an armed gunboat. Although an officer in the British Army, Hutchins was a native American and had begun his military career with the colonial troops of Pennsylvania during the French and Indian War (1754-1763). He entered the Regular Service of the King about 1762 and served in the campaigns of Colonel Henry Bouquet against the Pontiac Conspiracy in the Ohio Valley; at Colonel Bouquet's direction, Hutchins laid out and supervised the construction of a fortification at Fort Pitt, and his redoubt still stands today in Pittsburgh.[2]

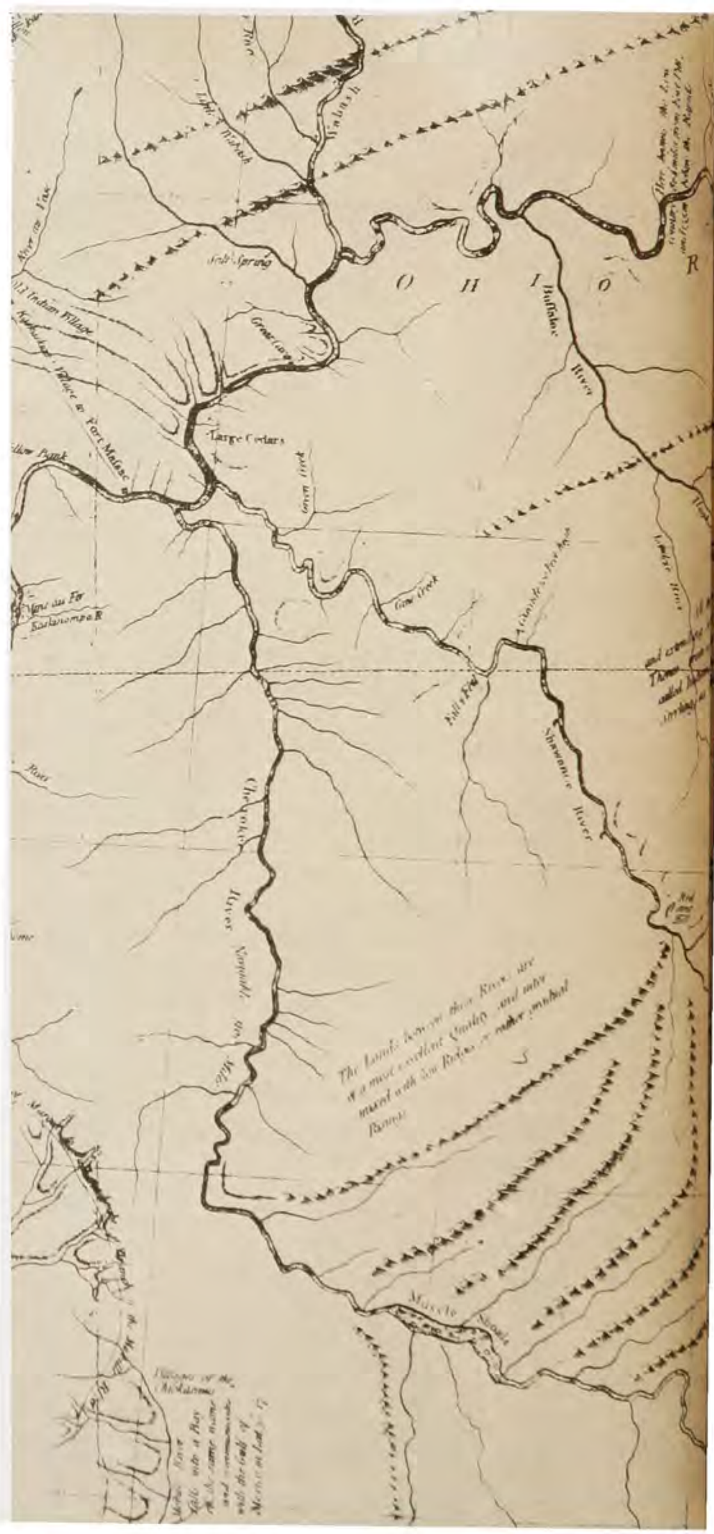
In 1766, Lieutenant Hutchins, as assistant engineer, accompanied Captain Henry Gordon, chief engineer of the Western Department of British North

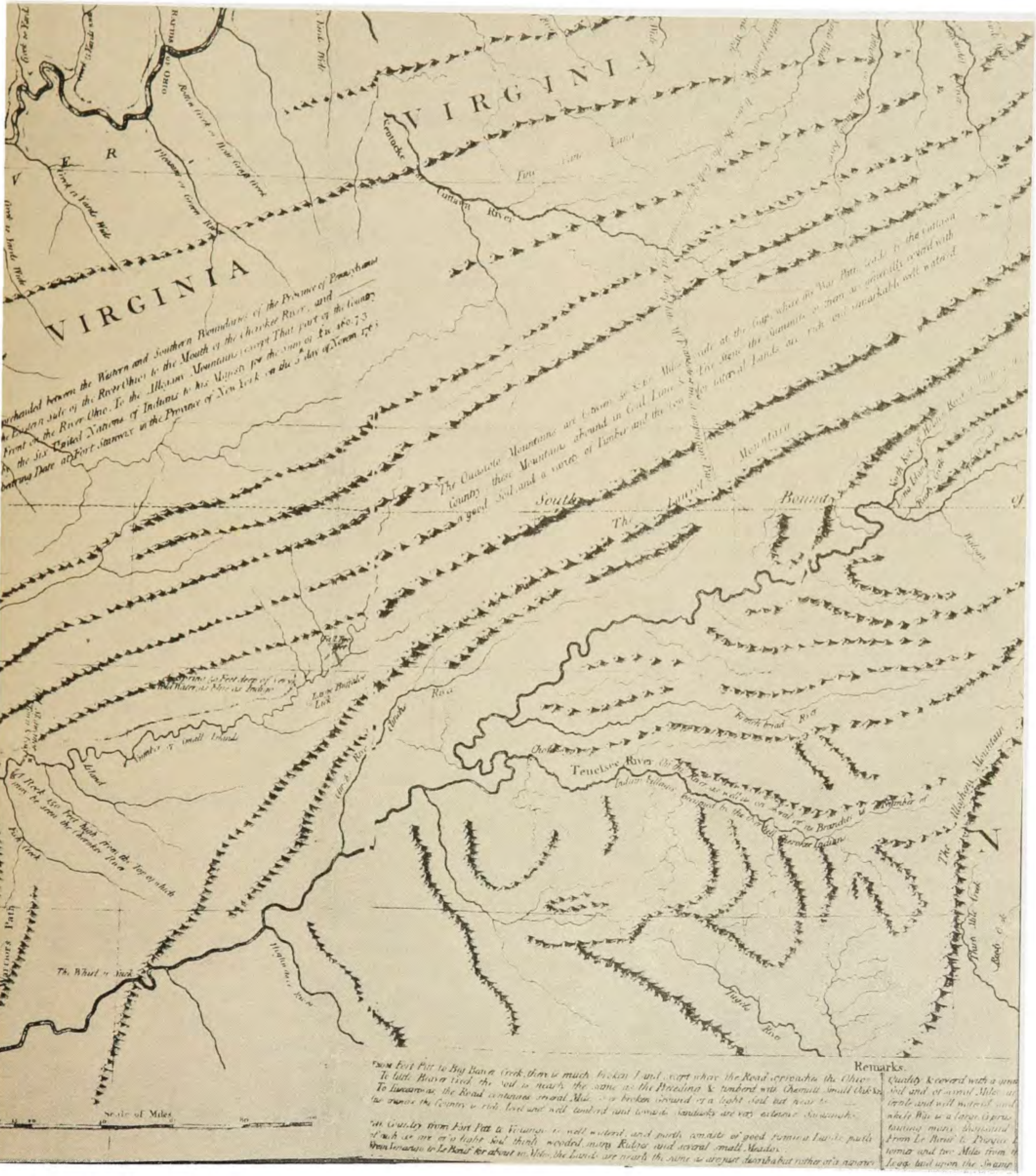
America, and George Croghan, a famed Indian agent, on a voyage down the Ohio and up the Mississippi to Fort Chartres in the Illinois country (which had recently been taken from the French). After topographical reconnaissance in Illinois, Hutchins returned to Fort Pitt by a circuitous route down the Mississippi, by ship to Havana and back to the East Coast, and then overland to the fort. He was again dispatched to Illinois, and from 1768 to 1771 he served at Fort Chartres and Kaskaskia under the command of Lieutenant Colonel John Wilkins of the Royal Irish Regiment.[3]

The British command in North America was then greatly disturbed by the activities of Spanish agents who continued to trade with the Indians in British territory east of the Mississippi. To curtail this trade, General Thomas Gage, commander of British Regulars, ordered the patrol of the tributaries of the Ohio River by armed boats to capture any foreign traders discovered violating British territory.[4]

Lieutenant Colonel Wilkins purchased a boat from a trading firm at Kaskaskia, and October of 1768 found Lieutenant Hutchins directing the work of carpenters in the conversion of a "Battoe into an Arm'd Galley" by raising the sides of the boat and installing a cannon. The galley, named the *Gage,* was propelled by twenty-four oars and was large enough to carry as many as thirty-five men with supplies sufficient for six months duty on the western rivers. A brass six-pound cannon was mounted on the forecastle of the galley and the gunwales were raised so "the men are not to be seen Rowing." The military mission of Hutchins' patrol was clear: it was to "intercept the french and Spanish traders from New Orleans, Carrying on an Illicit trade with our Indians at O Post [Vincennes, Indiana] and on the Rivers. It is likewise to prevent them from killing Buffalo. . . ."[5]

In the great "Arm'd Galley" Hutchins reconnoitered the western rivers and during the patrols he kept a journal describing the topographical features of the terrain and the navigational problems of the rivers. With crude instruments, he took compass readings, estimated dis-





map of the twin rivers by Hutchins.

tances, and made rough sketches for later use in map-making. The nature of the expedition, however, prevented complete accuracy in his topographical work, for on one occasion, as example, he noted in his journal that "here the Night overtook us but did not impede our Course[;] in the Morning we were veering South, and I was informed by them that watched as nigh as they could Judge that the general Course of the River the whole Night was from W. to SW. and S.—likewise that they passed 5 or 6 Islands. we allow'd 30 Miles for the Nights floating."[6]

Although prepared under most difficult conditions, Hutchins' maps and descriptions of the twin rivers were remarkably accurate. In his description of the "Shawanoe," as he called the Cumberland River, he remarked that it "empties itself on the eastern side of the *Ohio*, about 95 miles southwardly of the *Wabash* River. It is 250 yards wide at its mouth, has been navigated 180 miles in Battoes . . . and from the depth of water, at that distance from its mouth, it is presumed it may be navigated much further."[7]

His description of the Tennessee, which he called the "Cherokee" River, was more lengthy: "The *Cherokee River* discharges itself into the *Ohio* on the same side, that the *Shawanoe* River does, that is,—13 miles below or southerly of it, and 11 miles above, or northerly of the place where *Fort Massac* formerly stood, and 57 miles from the confluence of the *Ohio* with the River *Mississippi* [*sic*]." He added that the Tennessee River had been navigated 900 miles from its mouth, and further observed that navigation was seriously hampered by the Muscle Shoals and the Suck.[8]

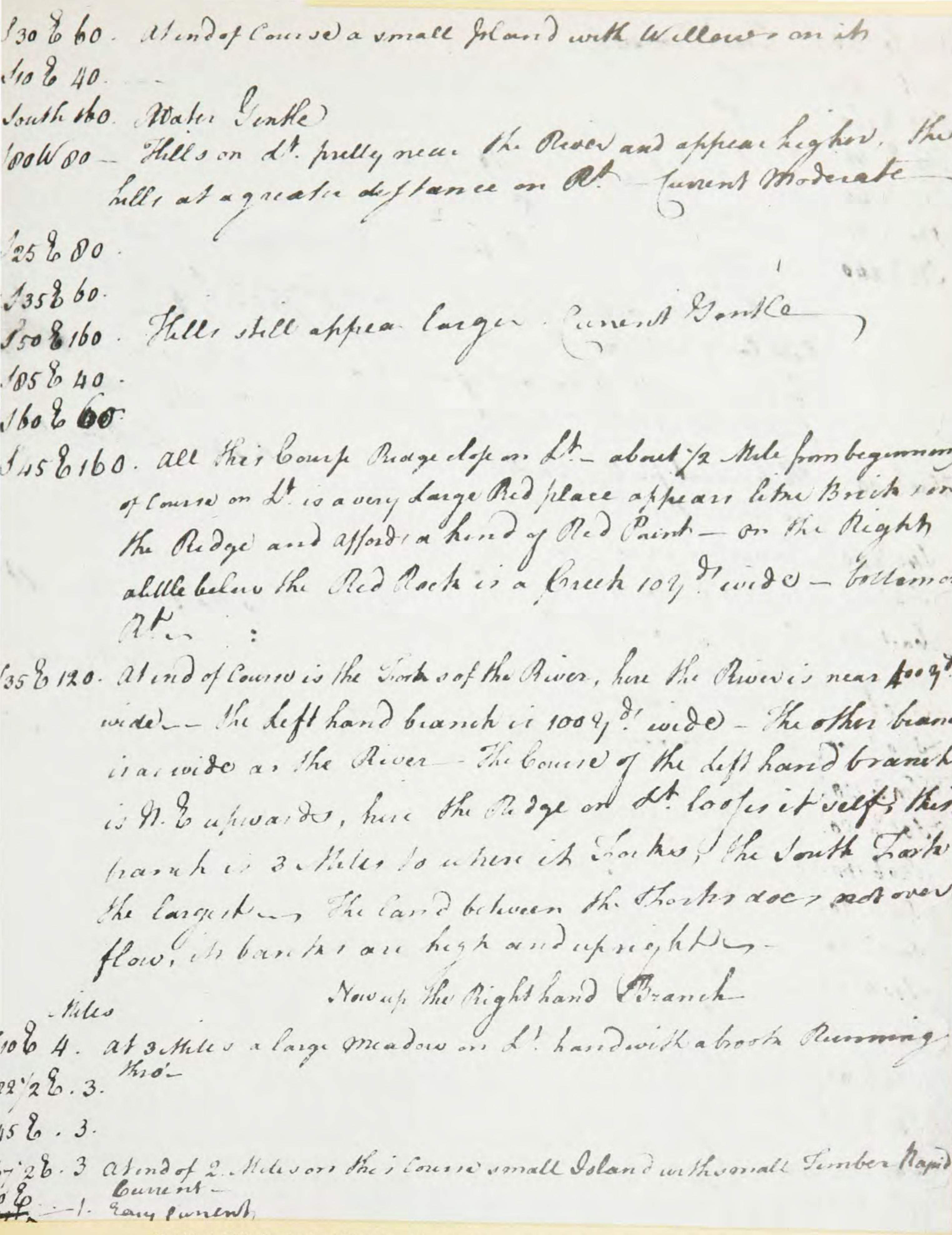
How far Lieutenant Hutchins took his patrol up the Cumberland and Tennessee rivers in person and how much information he garnered about the twin rivers from the hunting parties led by Joseph Hollingshead is uncertain, but the maps which resulted brought him quick recognition: in 1772 he was elected to the American Philosophical Society, and by the time of the Revolution he had attained the rank of Captain in the British Army. General Thomas Gage of the British Army relied on the dependability of Hutchins' topographical work, and General Frederick Haldimand found Hutchins very "exact in his Surveys and judicious in his Remarks."[9]

The American Revolution was a crisis for the young officer. Although a native American, he had spent twenty years in the service of the King and his only property of value was his commission as an officer and engineer. Still, he could not take part in a war against his countrymen—against the newly-created United States.

While he was in London in 1777, arranging the publication of his topographical descriptions and maps of the Ohio River Basin, American intelligence agents secretly contacted him and he corresponded with them. The correspondence was discovered by British agents and Hutchins was arrested, clapped into irons, and charged with high treason. The charges against Hutchins were not substantiated, but when he was released from prison he cut his ties with Britain, sacrificed all, and fled to France "in a private manner." There, he petitioned Benjamin Franklin for service in the Continental Army of the United States.[10]

Franklin sent him to America, which was desperate for military engineers, providing him with a recommendation as "a native of New Jersey . . . [who] has lately escaped from England, where he suffered considerably for his attachment to the American cause." He is, said Franklin, a "good officer and an excellent engineer."[11]

In America, Hutchins was assigned to the army of General Nathanael Greene in the campaigns against British General Cornwallis in the South, with the title "Geographer to the United States of America," indicating service as a topographical engineer. Hutchins remained in this capacity after the conclusion of the Revolution, serving with the party which completed the boundary survey between Virginia and Pennsylvania and directing the survey of the first four ranges of the Old Northwest (in Ohio, Indiana, and Illinois) after the enactment of the Land Ordinance of 1785. He has been credited with the development of

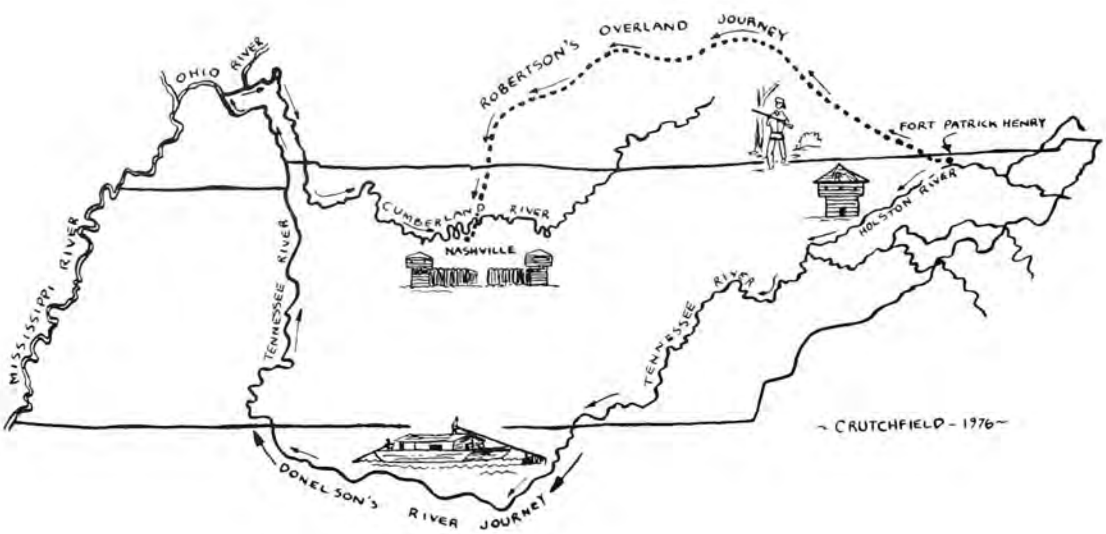


S30 E 60. At end of Course a small Island with Willows on it
S10 E 40.
South 40. Water Gentle
S00 W 80 – Hills on Lt. pretty near the River and appear higher, the hills at a greater distance on Rt. – Current Moderate –
S25 E 80.
S35 E 60.
S50 E 160. Hills still appear larger. Current Gentle
S05 E 40.
S60 E 60
S45 E 160. All this Course Ridge close on Lt. – about ½ Mile from beginning of Course on Lt. is a very large Red place appears like Brick on the Ridge and affords a kind of Red Paint – on the Right alittle below the Red Rock is a Creek 10 yds. wide – bottom on Rt. :
S35 E 120. At end of Course is the Forks of the River, here the River is near 400 yds. wide – the left hand branch is 100 yds. wide – the other branch is as wide as the River – The Course of the left hand branch is N. E upwards, here the Ridge on Lt. looses it self, this branch is 3 Miles to where it Forks, the South Fork the largest – The Land between the Forks does not over flow, its banks are high and upright –

Now up the Right hand Branch

Miles
S10 E 4. at 3 Miles a large Meadow on Lt. hand with a brook Running thro' –
S22½ E. 3.
S15 E. 3.
S7½ E. 3 At end of 2 Miles on this Course small Island with small Timber Rapid Current –
S E – 1. Easy Current

Hutchins' 1769 Cumberland River journal. Compass readings and distances in chains on left.



General route of the Robertson and Donelson parties in 1779-80.

the American survey system of six-mile square townships and 640 acres to the section.[12]

When Catherine the Great of Russia requested information from George Washington, through the Marquis de Lafayette, about the languages of the American Indians, Washington delegated the task to Hutchins, because, he wrote Hutchins, "a gentleman of your taste for science in general, and particularly of your capacity of acquiring the information in question, will enter upon the task with pleasure. . . ." Hutchins probably never furnished the Tsarina of Russia with the desired information, however, because he died at Pittsburgh at age fifty-nine in 1789.[13]

Thomas Hutchins' rise through the ranks of the British Army, his election to the American Philosophical Society, the high regard for his work expressed by George Washington, Benjamin Franklin, and British Army officers, and the important tasks assigned him by the American Congress are indicative of his talents as a topographical engineer. His position as "Geographer to the United States" made him, in effect, the first "Chief of Topographical Engineers" of the United States. Certainly, he was the first Army Engineer to examine and map with any accuracy the topography and hydrology of the Cumberland and Tennessee valleys.[14]

Of course, Thomas Hutchins and the "long hunters" were not the first to navigate the Cumberland and Tennessee; French traders had been operating in the twin valleys for nearly a century before Hutchins arrived in 1769, and the Indians had utilized the two rivers for transportation long before the Europeans arrived.

The dominant Indian tribes in the twin valleys were the Cherokees, settled in the Upper Tennessee Basin, the Chickasaws, west of the Tennessee, the belligerent Creeks south of Muscle Shoals, and the Shawnees along the Cumberland, though the latter were driven north out of the valley by other tribes about 1715. The tribes in the northern part of the United States and in Canada used birch-bark and elm-bark canoes for navigating the inland waterways, but in the twin valleys the dugout canoe, or pirogue, hollowed by fire or adz from the trunks of sycamore, cypress, cottonwood, and other trees, was more commonly used. Size, of course, varied with the dimensions of the tree trunk and the industry of the warrior who constructed it, but the largest reached fifty feet in length, five feet

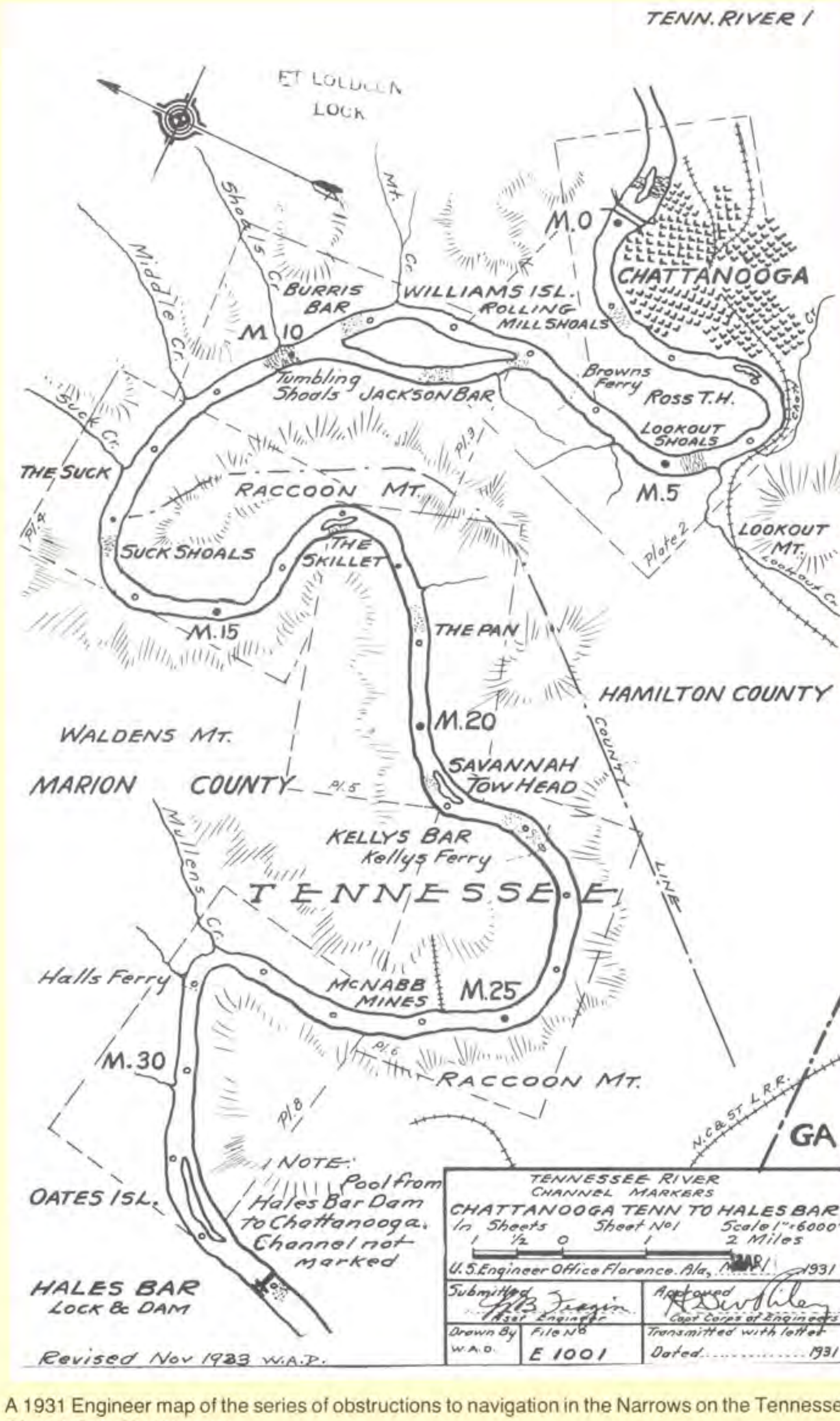
across the beam, and had a capacity of thirty men, or up to fifty tons of cargo. They were steered by an oar at the stern, and could, with great exertion, be driven against the current by poles and paddles.[15]

Lieutenant Henry Timberlake of the British Army, who traveled by canoe to the Cherokee villages in the Upper Tennessee Valley in 1761, described the canoes of the Cherokees as "made of a large pine or poplar, from thirty to forty feet long, and about two broad, with flat bottoms and sides and both alike; the Indians hollow them now with the tools they get from the Europeans, but formerly did it by fire: They are capable of carrying fifteen or twenty men, are very light, and can by the Indians, so great is their skill in managing them, be forced up a very strong current, particularly the bark canoes; but these are seldom used but by the northern Indians."[16]

There is little doubt that the "long hunters" used the same type of craft to carry buffalo tallow and hides to market from the Cumberland Valley to the Spanish posts on the Lower Mississippi after 1770, but the frontiersmen of East Tennessee who migrated west on the Cumberland and Tennessee rivers generally used the flatboat because of its greater cargo capacity. In 1777, Timothy Demonbreun found six white men and a woman camped on the banks of the Cumberland, near the present location of Palmyra, Tennessee, who had floated down river from the mouth of the Rockcastle River in Kentucky on their way to Natchez. Thomas Hutchins mentioned in 1778 that settlers were embarking at Long Island on the Holston River for voyages down the Tennessee, Ohio, and Mississippi rivers to New Orleans.[17]

The most striking account of early twin river navigation and its hazards is that of Colonel John Donelson, who led a flotilla of boats down the Tennessee and up the Cumberland to settle in Middle Tennessee in 1779 and 1780. James Robertson,

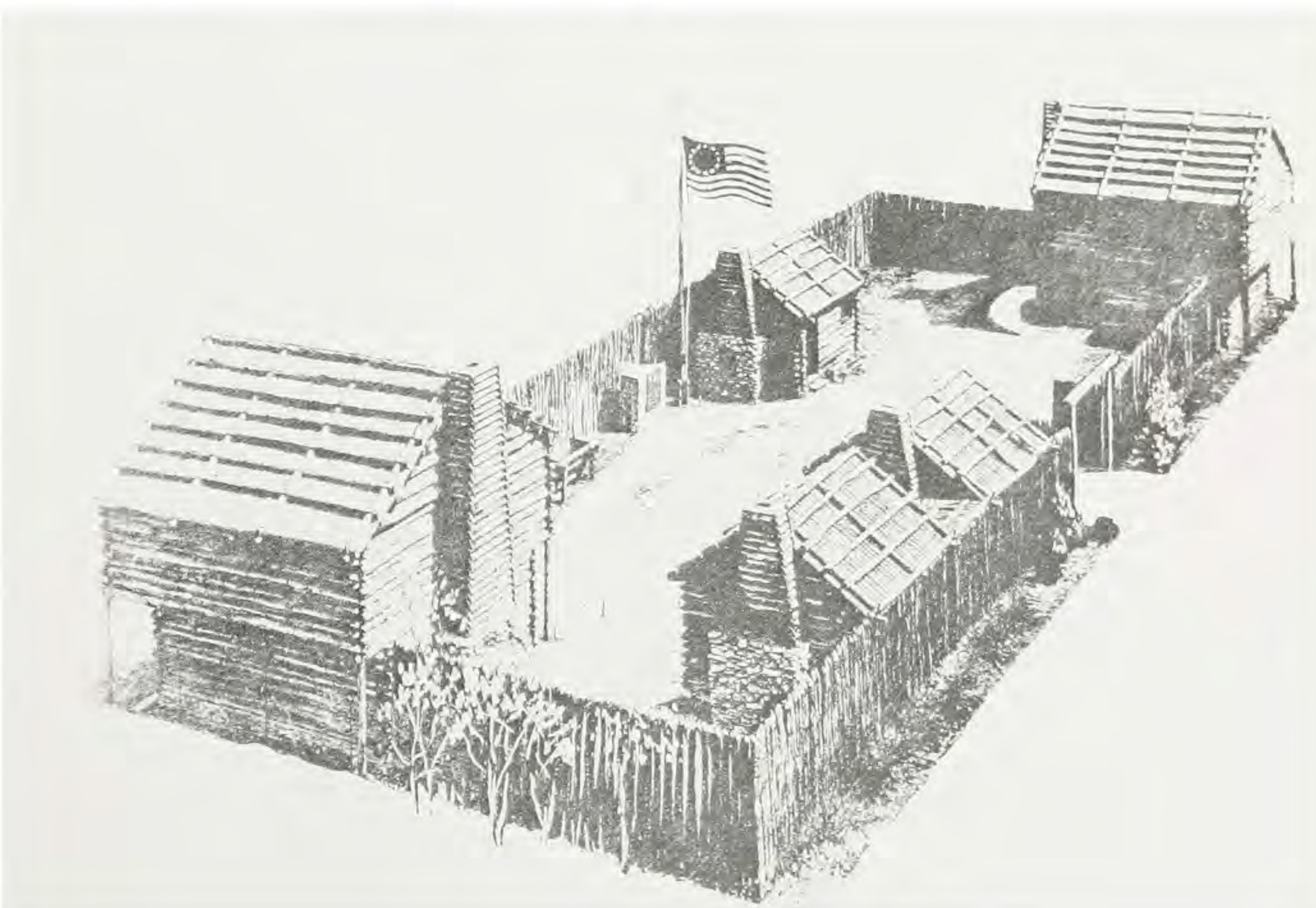
Falls over a rock ledge at Muscle Shoals, Tennessee River. These made the roaring sounds mentioned by John Donelson in 1779.



A 1931 Engineer map of the series of obstructions to navigation in the Narrows on the Tennessee River below Chattanooga.

A COMPANY of Gentlemen of *North Carolina* having, for a large and valuable Consideration, purchased from the Chiefs of the *Cherokee Indians*, by and with the Consent of the whole Nation, a considerable Tract of their Lands, now called *Transylvania*, lying on the Rivers *Ohio*, *Cumberland*, and *Louisa*; and understanding that many People are desirous of becoming Adventurers in that Part of the World, and wish to know the Terms on which Lands in that Country may be had, they therefore hereby inform the Public, that any Person who will settle on and inhabit the same before the first Day of *June* 1776, shall have the Privilege of taking up and surveying for himself 500 Acres, and for each tithable Person he may carry with him and settle there 250 Acres, on the Payment of 50s. Sterling *per* Hundred, subject to an yearly Quitrent of 2s. like Money, to commence in the Year 1780. Such Persons as are willing to become Purchasers may correspond and treat with Mr. *William Johnston* in *Hillsborough*, and Col. *John Williams* of *Granville, North Carolina*, or Col. *Richard Henderson* at *Boonsborough*, in *Transylvania*.——This Country lies on the south Side of the Rivers *Ohio* and *Louisa*, in a temperate and healthy Climate. It is in general well watered with Springs and Rivulets, and has several Rivers, up which Vessels of considerable Burthen may come with Ease. In different Places of it are a Number of Salt Springs' where the making of Salt has been tried with great Success, and where, with Certainty, any Quantity needed may be easily and conveniently made. Large Tracts of the Land lie on Lime-stone, and in several Places there is Abundance of Iron Ore. The Fertility of the Soil, and Goodness of the Range, almost surpass Belief; and it is at present well stored with Buffalo, Elk, Deer, Bear, Beaver, *&c.* and the Rivers abound with Fish of various Kinds. Vast Crowds of people are daily flocking to it, and many Gentlemen of the first Rank and Character have bargained for Lands in it; so that there is a great Appearance of a rapid Settlement, and that it will soon become a considerable Colony, and one of the most agreeable Countries in *America*. (6)

Richard Henderson's advertisement for settlers in Tennessee and Kentucky.



Reconstruction of the fort built at Nashville by Robertson and Donelson.

leading the advance elements of the migration, trekked overland from East Tennessee to the present site of Nashville in 1779, and the Donelson flotilla, with women and children aboard, followed, beginning its epic journey on December 22, 1779.[18]

Donelson's "flagship," the *Adventure*, was appropriately named, for it led the fleet of flatboats and canoes into one of the greatest adventures in the annals of frontier history. The beginning of the journey was most inauspicious, however, because the river fell and for over two months the party was delayed by impassable shoals, losing boats and almost losing passengers in the process. When the annual spring flood began to swell the Tennessee, the fleet floated off the shoals and began to make better time, passing the mouth of the French Broad River (Knoxville, Tennessee) on the second of March. But as they passed the Chickamauga villages (near present Chattanooga, Tennessee) the Indians attacked and captured the last boat in the fleet with twenty-eight unfortunate souls who were straggling behind because they were afflicted with smallpox. Legend says that the Indians were amply repaid for the murders by the dreaded smallpox plague.[19]

With the cries of the victims behind ringing in their ears, the pioneer navigators prepared to run the treacherous Narrows (Suck) in the Tennessee below the present site of Chattanooga. A canoe overturned in one terrific eddy, known as the "Boiling Pot," and the fleet halted while an effort was made to salvage part of the canoe's cargo, but Indians crept to the edge of the bluff towering over the river channel and fired down at the party, forcing a "precipitate retreat." The flotilla raced through the remainder of the Narrows as rapidly as possible, losing another boat at the "Whirl" while dodging Indian bullets.[20]

On the twelfth of March, the company reached the rampant, racing waters of Muscle Shoals, where they expected to find a sign from James Robertson which would indicate that they might end their voyage on the Tennessee and complete their journey by the safer overland route to Nashville. To their despair, there were no signs, and fear of renewed Indian attack forced the party to brave the hazards of Muscle Shoals.

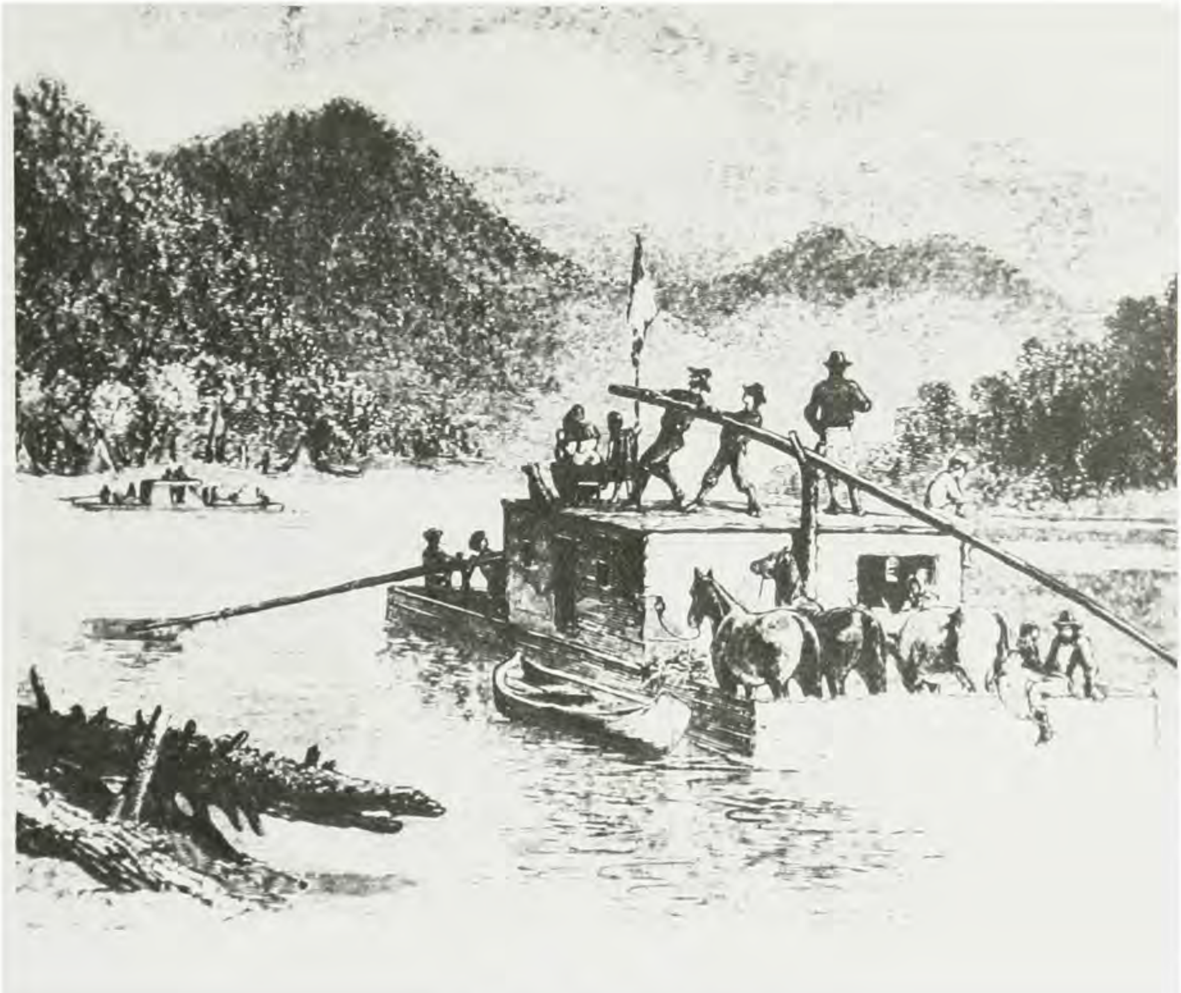
The river made a "terrible roaring . . . among the drift-wood heaped frightfully upon the points of the islands; the current running in every possible direction," said John Donelson. "Here we did not know how soon we should be dashed to pieces," he lamented, "and all our troubles ended at once." But the voyagers safely passed through the Shoals in about three hours and continued their voyage down the Tennessee.[21]

Five more of the adventurers were wounded in another Indian attack, but the flotilla reached the mouth of the Tennessee, near the present site of Paducah, Kentucky, on the twentieth of March, landing on the "lower point immediately on the bank of the Ohio." The most dangerous part of their voyage was over, but the most arduous portion lay ahead. The party was hungry, suffering greatly after the three-month trip down the Tennessee, and were faced with the task of forcing their way upstream against the rising waters of the cantankerous Cumberland in unwieldy craft entirely unsuited for upstream navigation. It took them four days to breast the current of the mighty Ohio the few miles from the mouth of the Tennessee to the mouth of the Cumberland.[22]

John Donelson rigged a sail on his boat and found it effective against the Cumberland's current, but the party doubtless expended much of their energy in paddling, poling, and pulling their weary way up river, often pausing to rest and hunt buffalo and pick "Shawanee Sallad."[23]

On April 12, 1780, the company arrived at the mouth of the Red River where Moses Renfro(e) and others landed to found the settlement which became Clarksville, Tennessee. The remainder of the party continued the tiresome journey and twelve days later were happily reunited with their friends, husbands, and fathers of James Robertson's party at the "Cedar Bluffs above the Lick"—Nashville.[24]

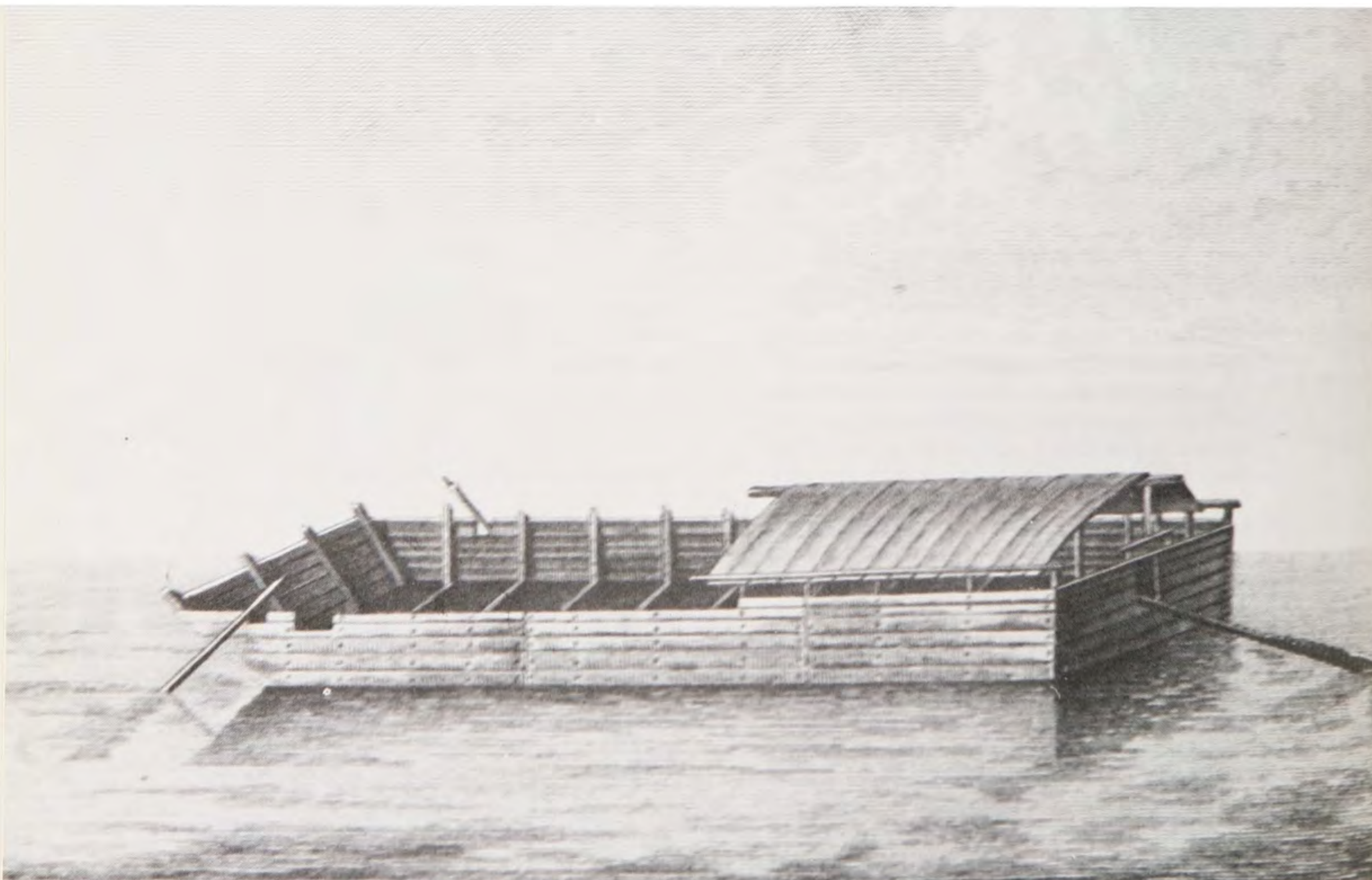
The difficulties the Donelson party faced and conquered in navigating the troublesome twin rivers were to plague



Pioneers flatboating west

navigators on the waterways well into the twentieth century. Shallow headwaters, barely navigable at the low-water season, eddys in the Suck where the channel of the Tennessee breaks through the mountains, and the chain of obstructions at Muscle Shoals were to present the United States Army Engineers with serious obstacles to their efforts to improve the navigability of the Tennessee River. Only high water permitted passage of these formidable obstructions, and then only with great danger. The spring rise on the Cumberland enabled the Donelson party to work tediously up the river to Nashville, but had their journey been undertaken at any other time of year shallow shoal waters would no doubt have prevented the pioneers from reaching Nashville by the river. As it was, it took them a month to force their way up to their destination.[25]

But, despite the difficulties of navigating the unimproved channel of the Cumberland, Indian resistance to the incursion of the settlers, and heavy duties laid on commerce by the Spanish on the Lower Mississippi, flatboats crammed to the gunwales with the bountiful produce of the Cumberland Valley were soon embarking from the Middle Tennessee settlements on the way to market at New Orleans. In 1785 North Carolina, of which the Tennessee settlements were a part until 1790, established a tobacco inspection in Davidson County and another at Clarksville in 1789. There was such an extensive trade on the Cumberland by 1797 that Congress established Palymyra, Tennessee, as a port of entry, one



Bradley R. Bidgood Photo

A "New Orleans" flatboat, with cargo entirely covered, 1874. (above)

Sketch of Flatboat, 1796. (below)

of the first on the Transappalachian frontier.[26]

The typical craft carrying the commerce of the twin rivers in the late eighteenth and early nineteenth centuries was the flatboat and variations with picturesque names such as "ark," "broadhorn," and "Kentucky boat." The one-way flatboat trade, one-way because of the difficulties of forcing the unwieldy boats upstream, increased throughout the first half of the nineteenth century, in spite of the development of keelboats and steamboats during the same period, peaking about 1846 on the Ohio and Mississippi. Although the Civil War practically ended flatboat traffic on the Ohio and Mississippi rivers, use of flatboats remained extensive on tributary streams such as the Cumberland and Tennessee in the postwar era and endured on mountainous headwater tributaries until the early twentieth century.[27]

Virgin forests greening the banks of the western river system rang with the clangor of axes biting deep into the grain as the settlers brought trees thundering down to be roughed into lumber for the flatboats. Construction was simple: the flatboat was merely a large, sturdy box spiked together with flat sides pitched slightly outward. If the journey to market was to be a long one, a roof might be constructed to protect cargo and passengers, and for cold-weather travel a stone fireplace might be added for heating and cooking, but the perils of navigation precluded much travel by night and the crew generally camped and built cooking fires on the river bank.[28]

A visitor to the twin valleys in 1802 described the flatboats as "of a square form, some longer than others; their sides are raised four feet and a half above water; their length is from fifteen to fifty feet; the two extremities are square, upon one of which is a kind of awning, under which the passengers shelter themselves when it rains."[29]

As the population along the banks of the western rivers increased, adventuresome entrepreneurs entered the lucrative river trade, plying the waterways with floating blacksmith shops, dry goods boats, liquor stores, and even libraries and wax museums. These mobile services must have meant a great deal to the lonely families settled on the rivers, but not everyone appreciated the services these boats provided. Reverend Timothy Flint, an early missionary in the Mississippi River Basin, suggested that a close watch ought to be kept on the "inmates and practices of these floating mansions of iniquity."[30]

Flatboats were used by Noah Ludlow and his touring thespian troupes when they brought the first professional dramatic productions to the entertainment-starved people of the twin valleys. Ludlow arrived in Nashville in 1817 after a flatboat trip down the Ohio and an overland barnstorming tour through Kentucky. He was oppressed by the heat in the young metropolis of Nashville, observing that "it is the hottest place I ever was in, and if the infernal regions are not beneath it, they are not far from it."[31]

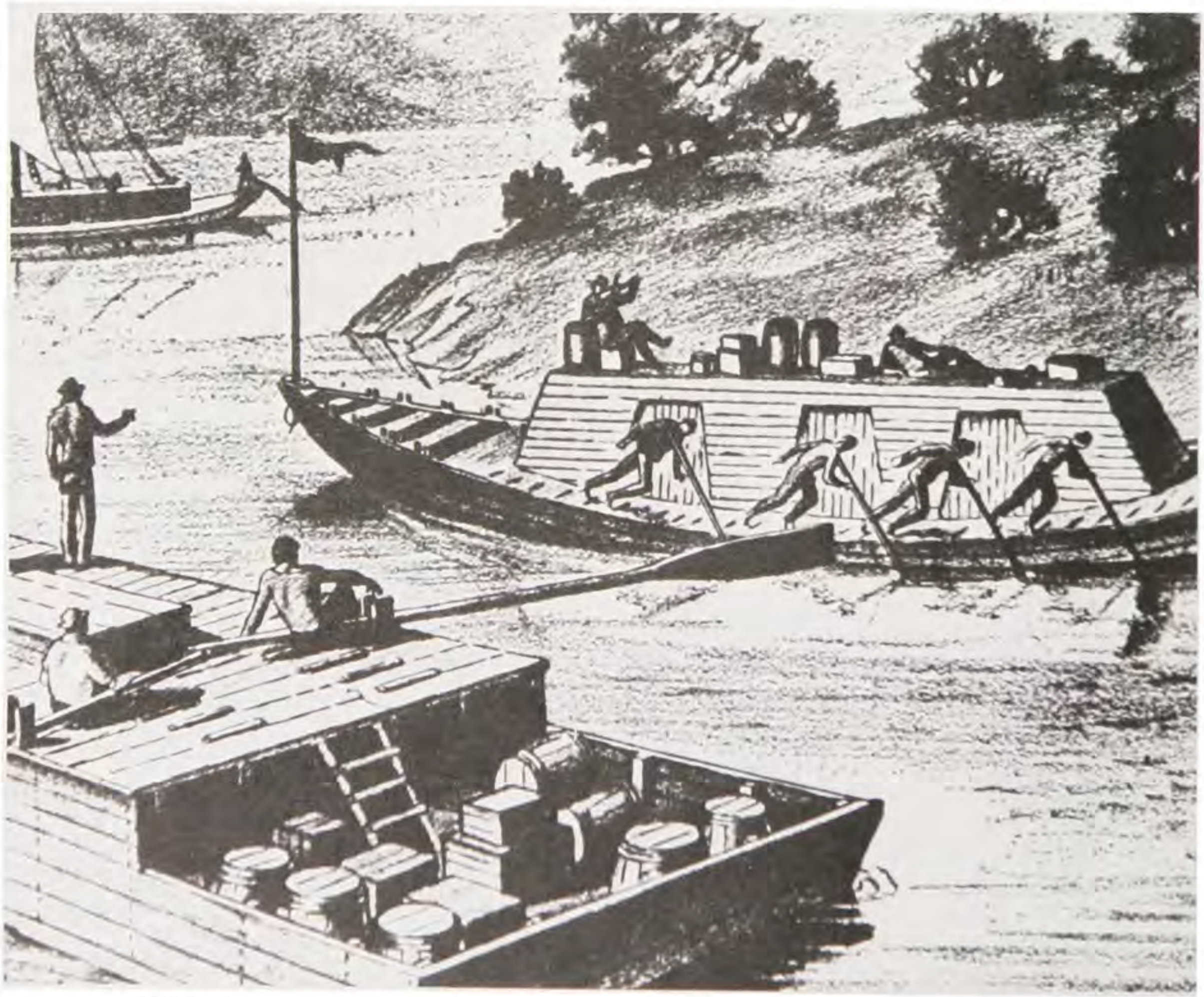
But, in spite of the heat, Ludlow opened a theater on the Square in Nashville and had a profitable season in several ways, choosing one of the local beauties as his bride. At the end of the season, he purchased a boat for $200 to take his performing troupe to New Orleans, and, except for Harpeth Shoals a few miles below Nashville, he found navigation on the Cumberland excellent. "This river," he was delighted to report, "is narrow, and rises and falls very quickly; but it is a beautiful water course, especially in the autumn and spring, presenting picturesque juttings of limestone, trees hung with vines of the wild grape, and green flowering creepers covering the rocks and branches of the trees, some of the latter drooping almost within reach of a passing voyager. At the time we descended the Cumberland, about the latter part of October, some of the trees had begun to assume their autumn hues, passing into the 'seared and yellow leaf;' and nature in her wild robes clad was then quite beautiful, for she was dressed in primitive virgin purity."[32]

Ludlow and other navigators may have enjoyed the pristine charms of river travel, but they also faced many hazards in running the unimproved, snag-studded waterways. Not the least of

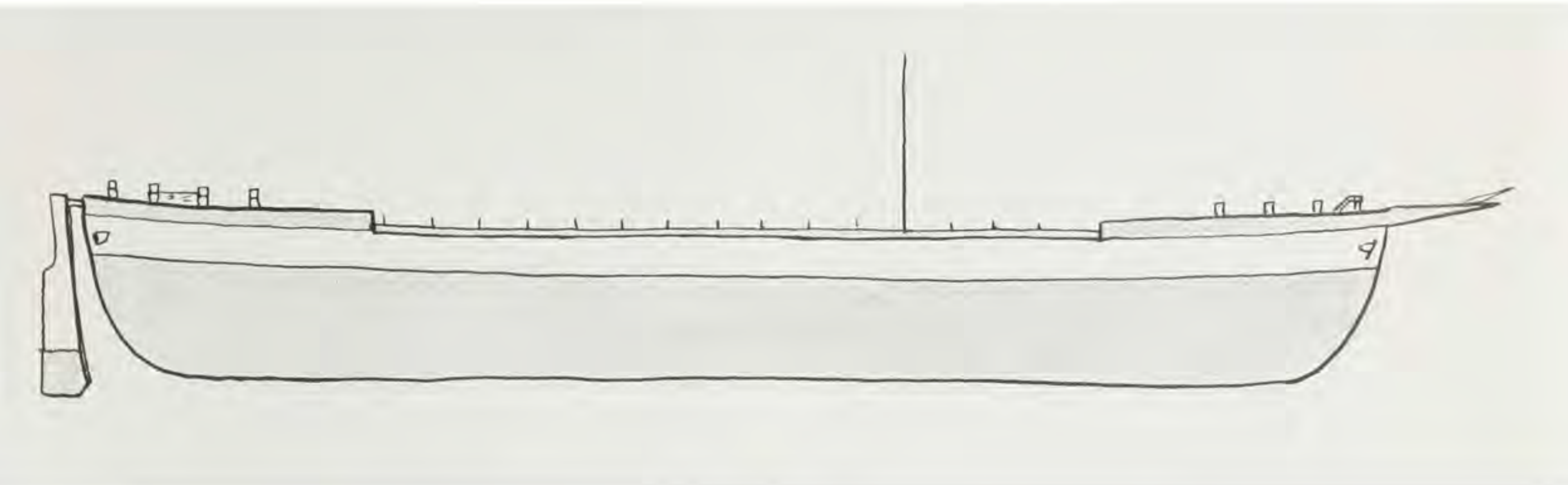
these hazards were the desperadoes who preyed on passing river craft. Above the mouth of the Cumberland was the infamous outlaw lair at Cave-in-Rock (Illinois), where the unwary or unarmed voyager might meet with a ghastly fate, and "Colonel Plug" and the "boatwreckers" preyed upon navigators from their hideout near Fort Massac just below the mouths of the twin rivers. The special technique of the "boatwreckers" was to offer to pilot boats through the dangerous Grand Chain of Rocks in the Ohio and then wreck them so cohorts could swarm around in skiffs to "save" the boats' cargo.[33]

Boatmen who successfully passed the latter peril and those of the journey down the rowdy Mississippi to New Orleans were then faced with a 700 mile walk back to Tennessee and Kentucky over the bandit-infested Natchez Trace, which traversed the deserted territory between the Yazoo and Tombigbee rivers to the Tennessee and from there to Nashville through the "barrens." Nevertheless, so many used this route that the Colberts, who operated a ferry across the Tennessee near Muscle Shoals, were said to have had an income of $2,000 per year from their ferry. At the charge of a dollar per traveler, the figure indicates a minimum of 2,000 men used the Trace annually.[34]

Commerce on the Cumberland was flourishing by 1800—an inspection station for flour, hemp, and tobacco was established in Pulaski County, Kentucky, on the Upper Cumberland in that year. Cotton, indigo, corn, whiskey, hogs, horses, cattle, salt-petre, bacon, apples, and many other articles were exported



Flatboat, keelboat, and sailing ship; all three navigated the Cumberland And Tennessee.



Plans for U. S. Navy gunboat built 1805-1807 by Matthew Lyon on Cumberland River at Eddyville.

from the Cumberland Valley. Imports generally came over the mountains from eastern cities. As early as 1795, Andrew Jackson was importing goods from Philadelphia to Nashville by wagon over the mountains to the Ohio River and down the Ohio and up the Cumberland by flatboat. He and his business associate, John Coffee, shipped produce to New Orleans regularly; in 1803 alone Coffee sent nearly 33,000 pounds of cotton down the Cumberland.[35]

Fleets of flatboats bearing Kentucky produce from points as far up the Cumberland as the mouth of Laurel River, a few miles below the great Cumberland Falls, descended on the annual spring floods to Nashville and beyond; the mouth of Laurel River actually became an official United States port of entry. Tributaries of the Cumberland also bore a substantial flatboat commerce. Jefferson in Rutherford County at the juncture of East and West Forks of Stone's River, 38.6 miles above the mouth of Stone's River, was an important port early in the nineteenth century. The flatboat *Kitty*, John Smith, Master, and the flatboat *Salley McGee,* James K. Benson, Master, arrived at New Orleans with cargoes of corn on May 1, 1805; the corn had been shipped by Mark Mitchell from Jefferson on Stone's River. Traffic on Stone's River was so substantial that the State established an inspection station at Jefferson in 1815 to inspect commodity quality, brand barrels with "TENNESSEE," and issue certificates of inspection to the shipmasters.

Flatboats descended Red River, a tributary that joins the Cumberland at Clarksville, Tennessee, from ports in Logan County, Kentucky. The Shaker colony at South Union in Logan County began shipping produce down Red River in 1824, sent six boatloads down the Red for New Orleans in 1828, ten in 1838, and continued the business until 1842. John Washington, a river pilot from Robertson County, Tennessee, swore in 1812:

> I hereby certify that I have descended Red River from four miles above where the Tennessee line first crosses the river, into the Cumberland, in a boat fifty feet long and fourteen feet wide. I know it to be perfectly navigable for such boat-loads with three hundred barrels of flour when the river is moderately swelled.

Flatboats navigated Obey River from points now far below Dale Hallow Lake and ran down Caney Fork from the Great

Falls near Rock Island, Tennessee. Harpeth River was navigable by Tennessee law; a state inspection station operated at Franklin, Tennessee; and in 1817 the keelboat *Western Trader*, owned by Dickenson, Cooper, and Bond of Franklin on the Harpeth registered at the port of New Orleans. At every spring "tide" prior to 1840, flatboats from these and other Cumberland River tributaries joined the fleet coming downriver from Kentucky to ply the markets on the inland waterways to New Orleans.[36]

The development of the keelboat, which facilitated upstream navigation, radically altered the course of commerce. About 1804, Andrew Jackson and others, who had previously been importing groceries and hardware from Philadelphia, began to make their purchases in New Orleans, because the goods arrived at Nashville more quickly and economically by keelboat from the "Crescent City" than by wagon and flatboat from Philadelphia.

The keelboat *Relief*, Wright Willis, Master, for example, departed New Orleans on May 8, 1809, with a cargo shipped by Meeker, Williamson, & Patton to Andrew Jackson. Included in the cargo were 10 hogsheads sugar, 1 hogshead rum, 1 pipe brandy, 7 trunks merchandise, 4 barrels coffee, 6 barrels fish, 1 cask nails, 2 boxes glass, 1 cask cider, 2 boxes raisins, 1 basket cheese, 1 box liquor, 2 boxes preserved fruit, and 8 crates crockery.[37]

Keelboats were classed as "barges," or "keels," the former being the larger, but the distinction was blurred. Both were constructed on a heavy timber keel, with a frame ribbed like a ship and planked over. Long, sleek, with a light draft, the keels were built for speed both up and down the river. A contemporary described the vessel as "about fifty feet in length, with a covered way, a kind of cabin occupying the entire hold of the boat, excepting spaces for small decks at each end, and a strip on each side the whole length of the boat, about fifteen inches wide, called the 'run' on which the men walked when 'poling' the boat upstream."[38]

Incredible exertions were required to work a keelboat upstream against the swift currents of the rampant western rivers. Poling was the customary method of propulsion, described best by Reverend Timothy Flint who said that twelve to fourteen hands poled a keel, "walking slowly forward, and half bent, with the shoulder firmly fixed against the knob of a long pole, whose iron point was set in the bottom, and thus apparently with great labour propelling the boat against the stream. As soon as they have walked the length of the boat, they raise their pole, walk forward Indian file, and renew their 'set,' as the phrase is, again."[39]

The keels ordinarily ran close to the river bank where the current was less swift, and on occasion the crews resorted to "bushwhacking"; that is, the crew seized low-hanging trees and bushes and walked the boat upstream while clinging to the bushes. As a last resort, the keelboatmen used the "cordelle," which was simply a long towline attached to the bow of the boat. Pulling the cordelle, the crew on the bank inched the boat along by sheer muscle and grit, fighting their way through rocks and brush and wading the creeks which entered the river. "Warping" was the reverse of cordelling; the towline being secured to a tree or boulder upstream and the crew aboard the boat pulling it up hand-over-hand, or cranking it forward on a simple windlass.[40]

Needless to say, the life of the boatmen was back-breaking, exhausting, and dangerous, but still adventuresome, luring many youths from their mundane homes on the banks of the rivers. The Reverend Timothy Flint observed, disapprovingly, that the "boats float by their dwellings on beautiful spring mornings, when the verdant forest, the mild and delicious temperature of the air, the delightful azure of the sky of this country, the fine bottom on the one hand, and the romantic bluff on the other, the broad and smooth stream rolling calmly down the forest and floating the boat gently forward—all these circumstances harmonize in the excited youthful imagination."[41]

Keelboats were plying the Cumberland regularly soon after 1800, bringing with them the niceties of life up from New Orleans. A typical keelboat, the "elegant

barge" *Mary Jane,* arrived at Nashville in 1809, just twenty-seven days out of New Orleans with a burden of fifty-seven tons. Built at Cincinnati, it was fitted out with masts, spars, and sails, and was eighty-seven feet long by fifteen wide, carrying a twenty-two member crew. Several merchants at Nashville, John Coffee among them, were soon engaged in the lucrative keelboat trade, operating keels with such provocative names as the *Minerva, Clem Hall, Nashville Packet, Willing Maid,* and the *Perseverance.*[42]

Even sailing ships were built on the Cumberland during the early nineteenth century, notably at the ports of Cairo in Sumner County, Tennessee, above Nashville, and Eddyville, Kentucky, near the present site of Barkley Dam. The schooners *Fanny and Maria* and *Concordia* were built by James Winchester, William Cage, James Cage, and William P Black at Cairo in 1807. The *Concordia,* which arrived at New Orleans on October 15, 1807, was 61.9 feet long, 19 feet wide, and was rated at 74 tons. The schooners *Beulah* and *Perseverance* and the brigs *Melinda* and *Clarissa Claiborne* were built by Matthew Lyon and his associates at Eddyville between 1805 and 1812. These vessels sailed to New Orleans where they were ordinarily sold for coastal and foreign commerce. The brig *Clarissa Claiborne* built at Eddyville in 1806 was 64.2 feet long, 21.1 feet wide, and drew 10.7 feet of water; it arrived at New Orleans on May 25, 1807, where it put on full canvas and sailed to Philadelphia, Pennsylvania, where it arrived on October 10, 1807. When the schooner *Perseverance* landed at New Orleans out of Eddyville in 1806, it had a cargo of 10,000 staves, tobacco, and twelve gun-carriages, shipped by Matthew Lyon.

Matthew Lyon was the radical Congressman from Vermont and later Kentucky, known for his fist-fights on the floor of Congress and the jail-term he had served for publicly criticizing President John Adams. Congressman Lyon had led settlers from New England to found Eddyville, Kentucky, where he engaged extensively in the shipping business. In 1805 he won a contract from the Navy Department to construct gunboats for naval service. He built at least four gunboats between 1805 and 1809, all sixty feet long, schooner-rigged, with cannon mounted on the forecastle. These vessels sailed to New Orleans, where they were commissioned and manned by sailors; they generally served for coastal patrol, but one of the four may have engaged in action against the Barbary Pirates off the coast of North Africa in the Mediterranean.[43]

The development of a flourishing river commerce on the Tennessee River, however, lagged far behind that of its northern twin, hindered by persistent Indian resistance to the settlers' encroachment and by more numerous obstructions to navigation. Conflicts with the Indians were not unknown on the Cumberland—several members of the Sevier family were ambushed and killed by Indians while navigating the Cumberland near Clarksville in 1792 and in the subsequent year a son of James Robertson met the same fate on the waters of Caney Fork—but the difficulties on the Tennessee were greater because of the large Cherokee and Chickasaw settlements in the Tennessee Valley and the fact that the Indian claims to the region were not extinguished by treaty until well into the nineteenth century.[44]

The experience of Major John Doughty, United States Army, in 1790 on the Tennessee amply illustrates the serious nature of the Indian resistance. Major Doughty was sent to deliver a message from the President to the tribes along the Tennessee River, and the Major dispatched an officer overland from the present site of Memphis to Muscle Shoals to pick up a party of Indian chiefs and descend the Tennessee to its mouth where the Major would deliver the message.[45]

Nevertheless, when Major Doughty arrived at the mouth of the Tennessee he found no officer and no Indians. He decided to ascend the Tennessee with a detachment of twenty men in a boat he described as a "barge." On March 22, 1790, the soldiers met four canoes carrying forty Indians and had what seemed a peaceful powwow, but as Major Doughty's party pushed off from the bank to continue the voyage the Indians opened

Snag and rock obstructed section of Caney Fork River. (above)

Rocky Shoals on the Powell River in Virginia. Flatboat captains waited until high water to cross these. (below)

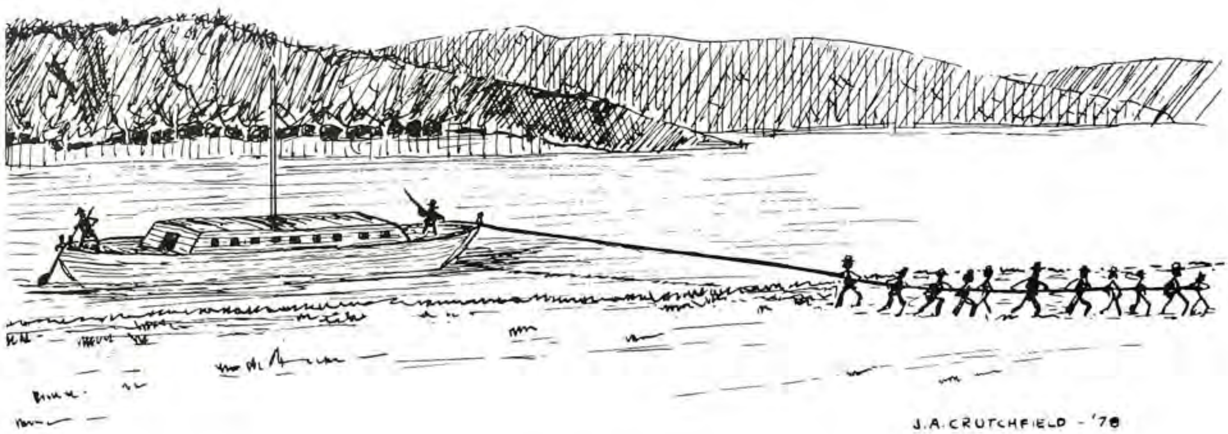
fire. Doughty "immediately put about in the stream & returned the fire." For four hours the troops exchanged a "warm fire" with the pursuing Indians while drifting down the Tennessee. Major Doughty lost five men in the engagement and had six wounded. The remaining men were not strong enough to navigate the barge upstream, and the party drifted down the Tennessee, Ohio, and Mississippi to a Spanish post where the wounded could receive the necessary attention.[46]

Trouble with the Indians of the Tennessee Valley continued until the War of 1812, but a small commerce did develop on the upper section of the river. The earliest traffic of record on the Tennessee River system were the immigrants who moved west, braving the Indian threat in their primitive craft, and a few entrepreneurs who also ventured downriver with cargoes. Thomas Amis of Hawkins County, Tennessee (then part of North Carolina), descended Powell's River, Clinch River, Tennessee River, and the Ohio and Mississippi rivers with a flatboat load of produce in 1786. He safely passed the Indians along the Tennessee River, but when he arrived at Natchez on the Mississippi, then part of the Empire of Spain, he was arrested by Spanish authorities and his cargo was confiscated. In 1797, two boats with five tons of cargo each—flour, salt, and whiskey—reached Knoxville from the South Fork of the Holston River in Virginia. Traffic moved further down the river in 1814 when Return J. Meigs, a well-known Indian agent who lived on the Hiwassee River, shipped a boat loaded with 623 bushels of corn and four barrels of flour to Ross Landing (now Chattanooga) for sale.[47]

A flatboat traffic on the Tennessee River system developed gradually. Agricultural produce from Virginia descended Powell's and Clinch River to Chattanooga and North Alabama—Huntsville and Decatur, Alabama, and surrounding area purchased great quantities of flour shipped south by flatboats to support the area's cotton economy. Salt was shipped from Saltville, Virginia, down North Fork of Holston, Holston River, and Tennessee River to ports between Knoxville and Decatur, and hammered iron products from the early furnaces in East Tennessee floated in flatboats down Watauga River, South Fork of Holston River, Nolichucky River, and the French Broad to the markets of Alabama. Some masters even risked the hazards of Muscle Shoals to gain access to profitable markets. Ignatius Dyer and the flatboat *Good Luck* arrived at New Orleans on May 6, 1806, with a cargo of 32 bales of cotton, 500 pounds of bacon, 200 pounds of lard, and 40 gallons of whiskey. Dyer had sailed from Sevierville, Tennessee, at the edge of the Smoky Mountains, down Little Pigeon River, French Broad River, and the inland waters. As another example, the flatboat *Viney*, James Nealy, Master, arrived at New Orleans on April 20, 1807, with a cargo of cotton. Captain Nealy listed as his home port Dandridge, Tennessee, and apparently had navigated the French Broad and Tennessee to Muscle Shoals, sold a cargo and purchased cotton in Alabama, and continued the trip to New Orleans.[48]

Flatboats also swarmed tributaries that join the Tennessee River below Muscle Shoals. Clark River in Kentucky, Bear Creek in Alabama and Mississippi, Big Sandy and Beech rivers in West Tennessee, Duck and Elk rivers in Middle Tennessee, all contributed their shares to the traffic. Flatboats departed from near Winchester, Tennessee, on Elk River and from Pulaski, Tennessee, on Richland Creek, a tributary of Elk River, to make the voyage to the New Orleans markets. Flatboats went to New Orleans from points 240 miles up Duck River, above Shelbyville, Tennessee, and a keelboat traffic also navigated the Duck. The keelboat *United States*, Thomas Gilbert, Master, and William G. Dickenson, Owner, operated out of Columbia, Tennessee, on Duck River in 1820. The boat was rated at 51 tons, was 108.8 feet long, 14.8 feet wide, and carried a mast and sails.[49]

But the difficulties of navigating the Suck and the Muscle Shoals on Tennessee River presented such obstacles that there was even speculation that East and Middle Tennessee might become two separate states. While the Cumberland



Cordelling a keelboat

and West Tennessee settlements engaged in a lively trade with New Orleans by way of the Cumberland, lower Tennessee, Ohio, and Mississippi rivers, East Tennessee traded with Atlantic seaports by an overland route because of the obstructions in the Tennessee River. A traveler observed in 1802 that Knoxville, the capital of Tennessee at the time, had only about 200 houses and no "manufactory" except a few tanyards. "They send," he said, "flour, cotton and lime to New Orleans by the river Tennessee [*sic*]; but this way is not much frequented by the trade, the navigation of this river being very much encumbered in two different places by shallows intersperced with rocks."[50]

It is evident that waterways transportation played a vital role in the early settlement and economic structure of the twin valleys, and the sinuous channel of the Cumberland soon became the principal artery of commerce for the Cumberland Valley, while traffic on the Tennessee languished because of Indian resistance and obstructions in the river channel. Indeed, until construction of railroads was initiated about 1840, the commerce of the twin valleys was largely dependent upon the waterways for movement to market.

Hazardous, winding, boulder-strewn, and snag-studded river channels did not deter the early navigators on the twin rivers from utilizing the most economical route to market—the waterways—and, although the commerce carried by flats and keels on the Cumberland and Tennessee was never reliable and always dangerous, navigation on the twin rivers was so extensive that attempts to improve the navigability of their channels and their tributaries were soon being urgently pressed by the three states through which the main streams of the twin rivers flow: Alabama, Kentucky, and Tennessee.

CHAPTER II

IMPROVEMENT EFFORTS OF THE STATES

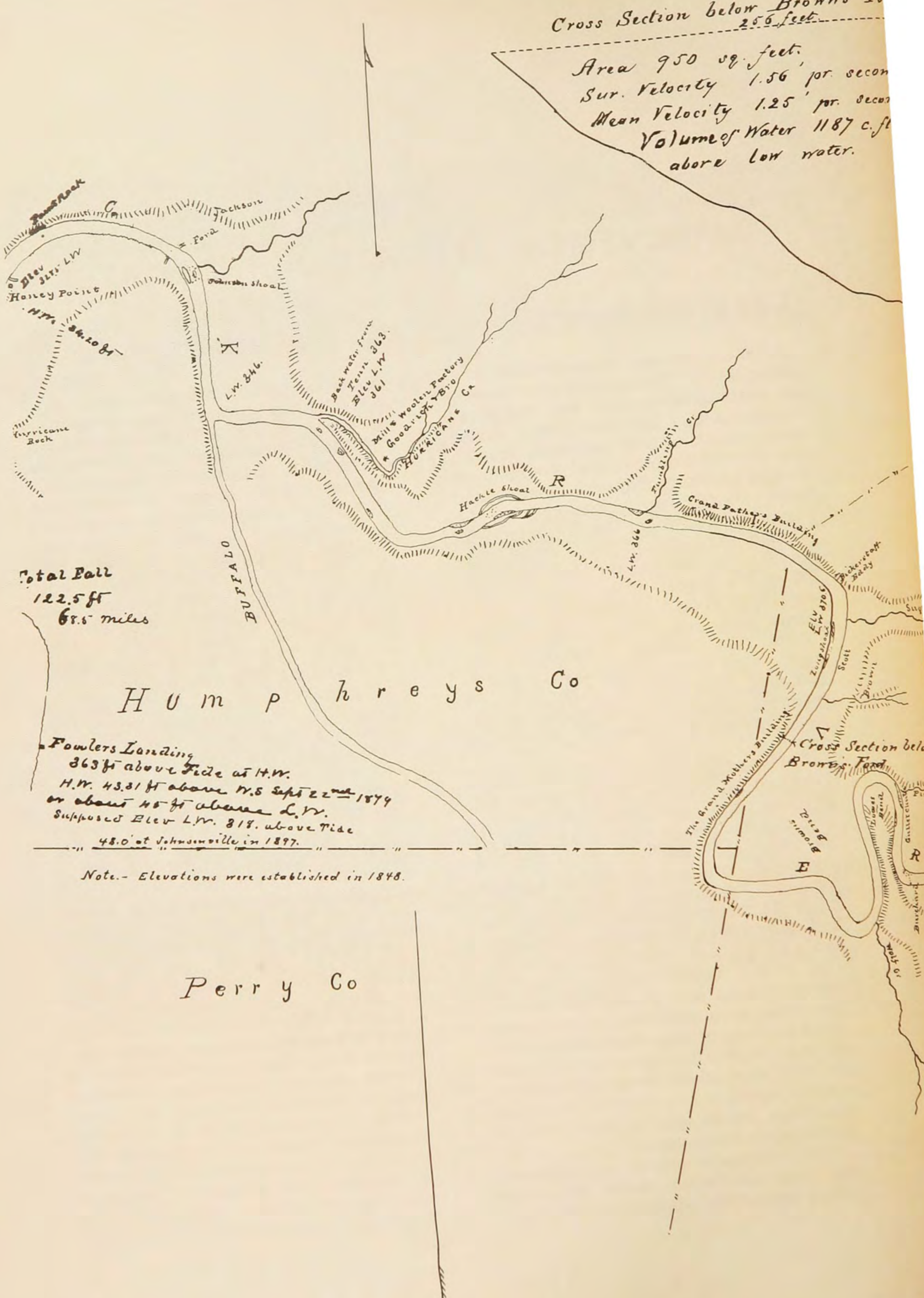
From the genesis of commercial navigation on the Cumberland and Tennessee rivers until the Civil War, the states through which the two rivers flowed made sporadic, and generally ineffectual, efforts to improve the navigability of the two streams and their tributaries, and these efforts were stimulated by the booming steamboat trade which developed after 1820. In their natural state, the twin rivers were practically impassable at the lowest water stages, strewn with rocky shoals and rapids, sand and gravel bars, and various other impediments. And, though boats might run during high waters, projecting boulders, turbulent currents, and timber snags in tortuous channels made navigation exceedingly perilous, even at the highest stages.

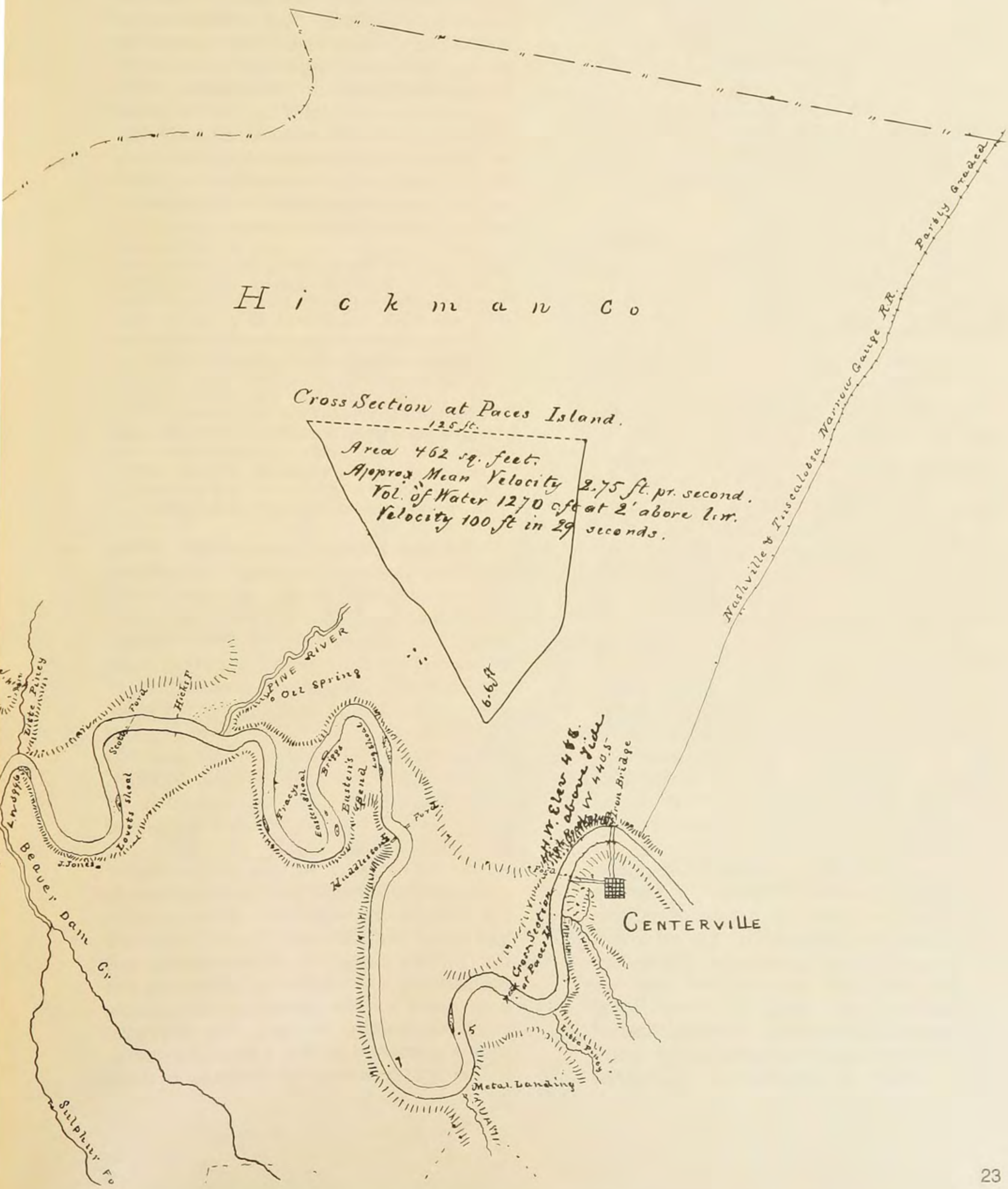
The wooden hulls of the cumbersome, rivercraft were staved in and ripped out at rocky shoals, and about all the boatmen could do was salvage as much of the cargo as possible. Disaster was not imminent, ordinarily, at sand and gravel bars, for the crews of stranded boats could clamber over the sides into the river and sometimes push their unwieldy boats off the bars, using poles as levers. That failing, boats might be freed by scooping sand and gravel from around their hulls, or a team of oxen or horses could be hired to drag the vessel back to the channel. But if all these efforts failed, the only alternatives remaining were to wait for a rise in the river, or to unload the cargo, lightening the boat, and reload it again downstream.[1]

The most-feared hazard, and it seems the most dangerous, were the snags which littered the channels of the inland waterways at all times. In the parlance of old rivermen, there were several varieties of snags: a "planter" was a log fixed in the river bottom by its roots with the free end pointed up to impale unwary boats; a "sawyer" was a planter whose free end danced up and down in the current with a sawing motion; and the "sleeping sawyer," lurking below the water surface, staved in the hulls of many unlucky passerbys. A boat which was embraced by a snag could kiss its cargo goodby, and many a riverman bade a fond farewell to his fortune as it slowly slipped beneath the rolling river waters.[2]

In addition to natural barriers to river navigation, man-made obstructions also became a hazard soon after the settlement of the twin valleys, especially on tributaries where there were ideal locations for small dams to power grist and saw mills. The harried rivermen urged that streams be declared navigable by the states in order that the channels of commerce be kept open, while those who desperately needed water power, practically the only mechanical power available until the mid-nineteenth century, took an opposite view, and state legislatures were flooded with petitions and counter-petitions over the issue.[3]

A case which most dramatically illustrates this early water-user conflict concerned navigation on the Red River, a shallow, meandering water-course which rises in Southern Kentucky and flows into the Cumberland River at Clarksville, Tennessee. Rivermen strenuously objected to the construction of mill dams on the Red River unless the Tennessee state legislature made it mandatory that each have a navigational lock, for other-


Cross Section below Brown's Fo
256 feet.
Area 950 sq. feet.
Sur. Velocity 1.56' pr. secon
Mean Velocity 1.25' pr. secon
Volume of Water 1187 c.ft
above low water.
Jackson
Ford
Johnson Shoal
Honey Point
Hurricane Rock
K
L.W. 346.
Backwater from Tenn 363. Elev L.W. 361
Mill & Woolen Factory Goodrich & Bro
Hurricane Cr.
Hackle Shoal
R
L.W. 366
Grand Father's Building
Total Fall
122.5 ft
68.5 miles
BUFFALO
Humphreys Co
Fowlers Landing
363 ft above Tide at H.W.
H.W. 43.31 ft above W.S. Sept 22nd 1879
or about 45 ft above L.W.
Supposed Elev L.W. 318. above Tide
48.0' at Johnsonville in 1897.
Note.- Elevations were established in 1848.
The Grand Mother's Building
Cross Section below Brown's Ford
Scott
E
Perry Co



A 19th century Engineer map of Duck River below Centerville, showing location of shoals, fords, landings, and prominent topographic features. The Duck River carried a substantial flatboat commerce, and steamboats reached Columbia.

wise dams would sever navigation on the stream and greatly increase transportation costs for the citizens above who were moving their produce to market at New Orleans via the waterways.[4]

The Red River was declared navigable, but the conflict was renewed when a silkworm craze swept over the Cumberland Valley. Many farmers hoped to abandon the uncertain business of farming and get rich by feeding the productive worms. Acres were planted in mulberry, men left the fields to feed the industrious worms, and everyone talked of the glorious future in silk.[5]

The silkworm magnates of Clarksville suddenly realized that so long as the Red River was classified as a navigable stream the people of Port Royal at the head of legal navigation had a monopoly on silk production because dams to power silk machinery could only be built at Port Royal or above. Port Royal capitalized a company for silk production, which erected a drying room and winding room near a dam on Sulphur Fork of the Red River; Clarksville, fearing it would miss the bonanza, pressed the legislature for the repeal of the law which declared the river navigable. Clarksville carried its point and the law was repealed, but ere long the Port Royal company was bankrupt: the organizer of the venture took the assets of the company, went to Europe to purchase machinery, and never returned. The silk balloon was ingloriously punctured and the Red River was again declared navigable. Nevertheless, silk production on a small scale did continue in the Cumberland Valley, although down to seventy-three pounds by 1888.[6]

Stone's River, tributary of Cumberland a few miles above Nashville, was protected for navigation by a Tennessee law of 1801, and citizens of Jefferson, chief port on the river, vigorously worked to protect navigation on the stream. When Moses Ridley and John Buchanan asked permit from the State to build a mill dam on Stone's River below Jefferson, leading citizens of Jefferson held a public meeting and dispatched a resolution of protest to the General Assembly:

> That if our Honorable, the Senate and House of Representatives, do not think expedient to secure to us the navigation of Stones river, according to a former law, and in opposition to certain petitions to legalize obstructions in the navigation of said river, we will be forced, again to think our rights infringed, and our interests disregarded. Wherefore, your memorialists respectfully pray, that your honorable body will take into tender consideration our peculiarly critical situation, and by rejecting all petitions to obstruct the navigation of Stones river to the town of Jefferson.

The State allowed construction of the mill dam, but required that the builders install navigation locks at least sixty-seven feet long and sixteen feet wide. Navigation interests in the Stone's River Valley fought a long and generally successful battle to prevent obstruction of the stream, for huge rafts of cedar timber floated down Stone's River every spring until about 1885 and was shipped to Louisiana, Mississippi, Illinois, Indiana, and Ohio. Many of the mansions in Cincinnati, Ohio, were constructed of Stone's River red cedar.[7]

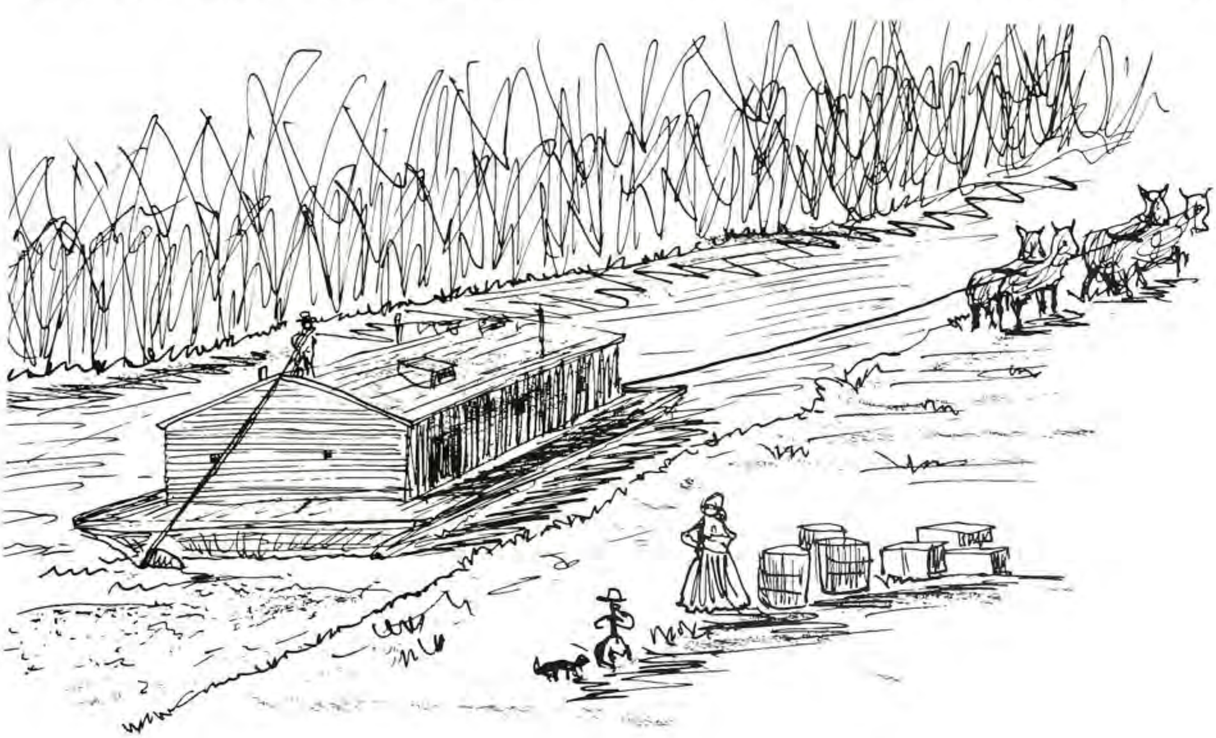
The navigation versus water power dilemma on the Red and Stone's River in the nineteenth century demonstrates that conflicts between water users are not entirely a modern phenomenon, and the same is true of efforts to improve the twin rivers for the benefit of navigation, which antedate, in fact, the improvements executed by the Army Engineers.

The first governor of Tennessee, John

Sevier, believing that navigation of the rivers was the "natural and inherent right of this state," urged the state legislature in 1801 to "take immediate measures for the attainment and improvement of all such parts of the exportable rivers . . . [and] that you seriously address the national legislature for their immediate aid to open and facilitate every obstacle that impedes the shortest and most convenient intercourse between [Tennessee?] and Orleans, Mobile, Pensacola, and any other port on our side of the Atlantic. . . ."[8]

In response to the Governor's suggestion, the General Assembly chartered the Nolichucky River Company in 1801, authorizing it to remove obstructions from the stream to establish a minimum channel width of twenty feet and depth of eighteen inches. The Nolichucky River, formed by the North Toe, South Toe, and Cane rivers high atop the mountains of western North Carolina, drops off the mountains through a two-thousand foot gorge into Tennessee and flows a hundred miles across Unicoi, Washington, Greene, Cocke, and Hamblen counties to its juncture with the French Broad, tributary of Tennessee River. Immense quantities of such iron products as plowshares were shipped from pioneer iron furnaces in Unicoi and Washington counties to Knoxville and southern ports. George Gordon, operator of an iron furnace on the Nolichucky, counted 38 flatboats jumping his mill dam on a flood in two days in 1840. The Nolichucky River Company was formed chiefly to aid this early industrial commerce. The company was authorized to sell stock and charge tolls for use of the improved river channel, but apparently accomplished little, for the Nolichucky Navigation Company was chartered to improve the same river in 1813.[9]

The project on the Nolichucky was typical of many early efforts by the State of Tennessee to improve its rivers: the legislature merely chartered a company to do the work and authorized it to sell stock, conduct lotteries, or charge tolls to finance the project. Generally, no permanent improvements resulted, and as early as 1815 Governor Joseph



Mules often towed flatboats off of shoals and bars.

Navigation laws required mill dams to have sluices for flatboats.

McMinn was suggesting the direct appropriation of state funds for river navigation improvement.[10]

In 1817, Tennessee authorized the application of funds derived from the sale of public lands to the improvement of the Holston and Tennessee rivers, and created a board of commissioners to direct the project. By 1819 the board was offering enticing wages and fringe benefits to attract workmen: "We . . . now offer fifteen dollars per month for ablebodied men. We will find them with good wholesome diet, and one pint of whiskey per day. It may be well for each one to bring with him a blanket. We will assemble in Knoxville."[11]

What improvements resulted from these labors is not known, although it is strongly suspected that a pint per day guaranteed that the river channels would be no straighter than before work began.

The Commonwealth of Kentucky conducted the same sort of simple river improvement operations with a $40,000 appropriation for the Licking, Salt, Kentucky, and Cumberland rivers in 1818. Commissioners were appointed for each stream and the entire appropriation was expended within a year, but with little memorable effect.[12]

When Alabama entered the Union in 1819, it also took an immediate interest in the improvement of its waterways, and like Tennessee chartered many private companies which proposed to accomplish river improvement projects.

The Flint River Navigation Company was chartered in 1820 to improve the Flint, a tributary of the Tennessee in Madison County, Alabama. The company went heartily to work, felling bush and timber over-hanging the little stream into the water in the belief that the spring rise would flush the wood into the Tennessee and merrily away to foreign parts. To the disgust of people living along the tiny stream, spring freshets failed to clear the river of the tangled mass of timber which had been felled into it and the Flint was closed to any navigation at all.[13]

On the other hand, the Indian Creek Navigation Company, also chartered in 1820, sought to improve a little stream between Huntsville and Triana on the Tennessee River, thus opening a water route from Huntsville to navigable waters. The company constructed a canal,

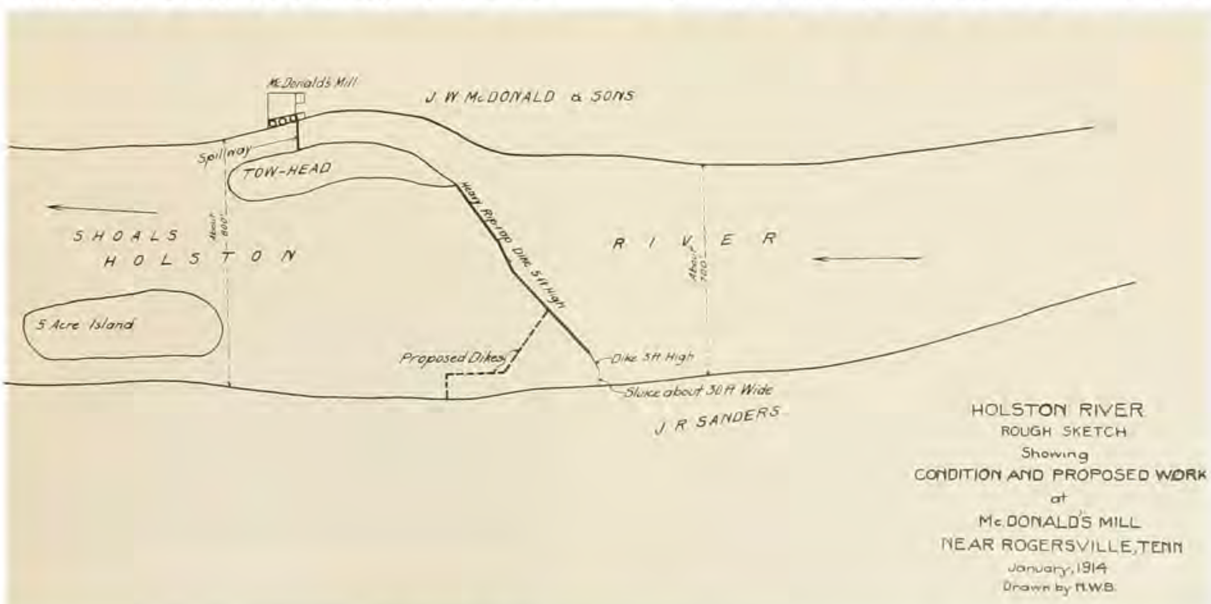
named Fearn's Canal after the president of the company, which was fifteen miles long and had thirty feet of lockage. It was opened to boats of fifteen tons burden in 1827, mostly keelboats loaded with cotton which was transferred to larger vessels at the mouth of Indian Creek and floated down over Muscle Shoals when a freshet hit the Tennessee.[14]

But the successful Indian Creek Company was an extraordinary example of the efforts of the states to improve navigation. More typical was the Spring Creek Navigation Company, chartered by Alabama in 1824 to improve the channel of the stream to expedite the passage of keelboats from Tuscumbia to the Tennessee River. In 1825, the Spring Creek Company began construction of its project by holding a river improvement BARBECUE, advertising in the local paper that "it is determined to remove logs and other obstructions out of Spring Creek so as to admit boats up to town. All are asked to furnish as many hands with axes as possible. Plenty of well barbecued meat and good whiskey."[15]

Support for the improvement of river navigation received an additional boost when steamboats began to roil the western waters. Many have laid claim to the invention of the steamboat, but it was actually a complex development which culminated several decades of experimentation by many men, two Kentuckians, John Fitch and James Rumsey, among them. However, Robert Fulton's successful operation of a steamboat on the Hudson River in 1807 brought him the credit for the invention.[16]

When Fulton and his associates built a steamboat on the western rivers, the *New Orleans,* and Nicholas Roosevelt ran it down the Ohio and Mississippi to New Orleans in 1811, they had hopes of acquiring a monopoly on steamboat operations on the inland waterway system, but these plans were frustrated by independent western rivermen like Henry Miller Shreve. Shreve was a colorful character who had begun his career on the waterways as a keelboatman, and perhaps this back-breaking experience explained his keen interest in the development of a steamboat specially adapted to the conditions on the western rivers—one with the engine on the deck instead of below it, which floated on the water rather than in it, and which had the paddle wheel at the stern instead of the sides.[17]

Great excitement was engendered in the twin valleys by the potentialities of the steamboat, and in 1816, just five years after the voyage of the *New Orleans*, a meeting was held in Nashville to



A 1914 Engineer map of J. W. McDonald's mill and dam on the Holston River near Rogersville, Tennessee. The dam diverted water around the towhead to the mill; the sluice for flatboat and log raft traffic was an opening in the dam next to the bank opposite the mill.

organize a steamboat company. In April of 1818, the *General Jackson,* steaming from Pittsburgh to New Orleans, tried to get up to Nashville, the home of its namesake on the Cumberland, but was prevented from reaching its destination by low waters at Harpeth Shoals a few miles below the city. On a return trip, the *General Jackson* reached Harpeth Shoals from New Orleans in just twenty-one days and six hours, but again was foiled by low water at the Shoals. The crew was unloading its cargo when one of the Cumberland's sudden rises occurred, permitting it to continue its trip, and it arrived at Nashville, the first to do so, on March 11, 1819.[18]

A Nashville newspaper began to harp on the subject of Harpeth Shoals, observing that the *General Jackson* had reached Nashville only once because of the obstructions in the Cumberland and expressing the hope that the Tennessee legislature would provide for the improvement of the river. But little was done and Harpeth Shoals remained an obstacle to traffic. Many steamboats towed flats and keels behind them on the way down from Nashville to get as much cargo as possible below the Shoals before the river fell, and many steamers were damaged or sunk while navigating the Shoals: the first steamboat on the Cumberland, the *General Jackson*, wrecked there in 1821 and the *General Greene* met a similar fate in 1824.[19]

A graphic account of the problem at Harpeth Shoals was written by the thespian Noah Ludlow, who had founded the first professional theater in Nashville in 1817. In 1822, Ludlow took passage on a boat bound from New Orleans to Nashville, but to his disgust he was put ashore at Smithland because the steamer could go no further up the shallow channel of the Cumberland. He boarded a smaller steamboat, the *Leopard*, to complete the journey, but it was, lamented Ludlow, "the most miserable apology for a steamboat that could have been started anywhere. . . . The main shaft of this boat was made of *wood*, with four or five buckets on each end about the dimensions of a laundress's washboard; and her power . . . must have been *one mule* and a *jackass*;

Canoeist portage past milldam on Red River in Logan County, Ky.
chapter 1

The North and South Forks join at Kingsport to form the Holston River.

Getting broadside to the current meant trouble at rapids and shoals on unimproved rivers.

Milldam on Elk River downstream of Fayetteville

Looking into Tennessee from North Carolina through the Nolichucky River gorge

Jack Custer Photo

Ferry at junction of French Broad and Holston rivers, forming the Tennessee River, 1907.

at all events it was not sufficient to stem the current of the Cumberland at certain points of the river."[20]

The *Leopard* paused to "wood up" its boilers at dusk, just below Harpeth Shoals, and while it was loading, Ludlow retired for the night. He was lulled to sleep by the rumble of the boat chugging up river, but, when he walked out on deck in the morning and looked about, his surroundings seemed strangely familiar. The captain explained that during the night the boat had thrashed its way up near the head of Harpeth Shoals when its wood supply had given out, and so it had drifted back to the same spot it had left the previous evening to load wood again. The boat made another futile attempt to breast the currents of the Shoals, but again ran out of wood, and the captain gave up and hired two yoke of oxen to pull the hapless steamer over the Shoals.[21]

All steamboats, however, were not as pathetic as the little *Leopard*; indeed, many were gaudy palaces which enhanced the comfort of river travel considerably. The Reverend Timothy Flint observed in 1828 that strangers aboard a fine steamboat for the first time would be amazed by the "prodigious establishment, with all its fitting of deck common, and ladies' cabin apartments. Overhead, about him and below him, all is life and movement. He sees its splendid cabin, richly carpeted, its furnishings of mahogany, its mirrors and fine furniture, its bar-room, and sliding-tables, to which eighty passengers can sit down with comfort. The fare is sumptuous, and every thing in a style of splendour, order, quiet, and regularity, far exceeding that of taverns in general."[22]

Several towns along the Cumberland soon became steamboat construction centers, with fine vessels being built at Dover, Clarksville, and Nashville. Smithland, at the confluence of the Cumberland and the Ohio, turned out some particularly well-known boats, such as the *Bonnet O'Blue,* the *Harry Hill*, the *Hermitage*, and the series of vessels which bore the proud name of *Smithland*.[23]

By 1824 a dozen steamboats were running in the booming Cumberland

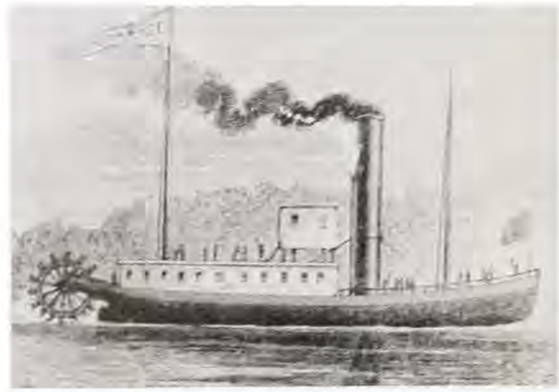
trade, exporting fine tobacco, hemp, cotton, and by 1830 pig iron from the Cumberland furnaces was beginning to reach Pittsburgh. Riding the puffing steamers from the other direction, up to Nashville, were imports such as nails, glass, dry goods, groceries, luxury items, and hundreds of other articles.[24]

The sylvan green waters of the Upper Cumberland were broken by the thrashing paddles of steamboats about a decade after they first reached Nashville. The *Rambler* struggled up to Creelsboro, Kentucky (near the present site of Wolf Creek Dam), in 1833, and returned with a profitable load of freight and passengers. In the same year, the *Jefferson* reached Point Isabel, Kentucky (renamed Burnside after the Civil War), and the mountainous Upper Cumberland region was opened to a new era of trade and prosperity. The Cumberland River was to be really the only access to the resources of the upper valley until the railroad crossed it in 1880, and for portions of the region the importance of the steamboat trade endured for a century.[25]

The advent of the steamboat launched an economic revolution; steamboats reduced the costs of transportation and, thereby, the price the consumer paid for merchandise. It was reported in 1825 the steamboat trade had dropped the price of sugar at Nashville from 24¢ a pound in 1817 to 9¢ a pound in 1825, coffee from 50¢ to 25¢ per pound, and salt from $3.00 to 75¢ a bushel. Furthermore, they brought new and ostentatious luxuries to the people of the Cumberland Valley. The *Lady Washington*, for example, arrived at Nashville from New Orleans in 1829 laden with "superior Jamaica Coffee," "Baltimore oysters," pepper, fresh almonds, sperm candles, "assorted Cordials," and "Champaign wine."[26]

Gourmets were not, however, the only citizens who benefited from the steamboat trade on the Cumberland. Benefits were widely spread; for example, the budding iron industry in the Cumberland Valley was able to reach other markets, as noted by the Pittsburgh *Gazette* in 1830:

> Some time ago we noticed the arrival of a quantity of pig metal from Tennessee. Since then another boat has brought to our wharves a considerable quantity of blooms from the same works. A more forceful exemplification of the advantages conferred upon the Western Country by the introduction of steam power could not be given than is afforded by this single circumstance. Fifteen years ago, thousands of tons might have lain at the works on the Cumberland, and foundries and steam engine factories might have remained idle for months for want of materials. Indeed, if the metal had been delivered gratuitously on board keelboats and barges at the mouth of the Cumberland, the price here would not have paid the freight.[27]

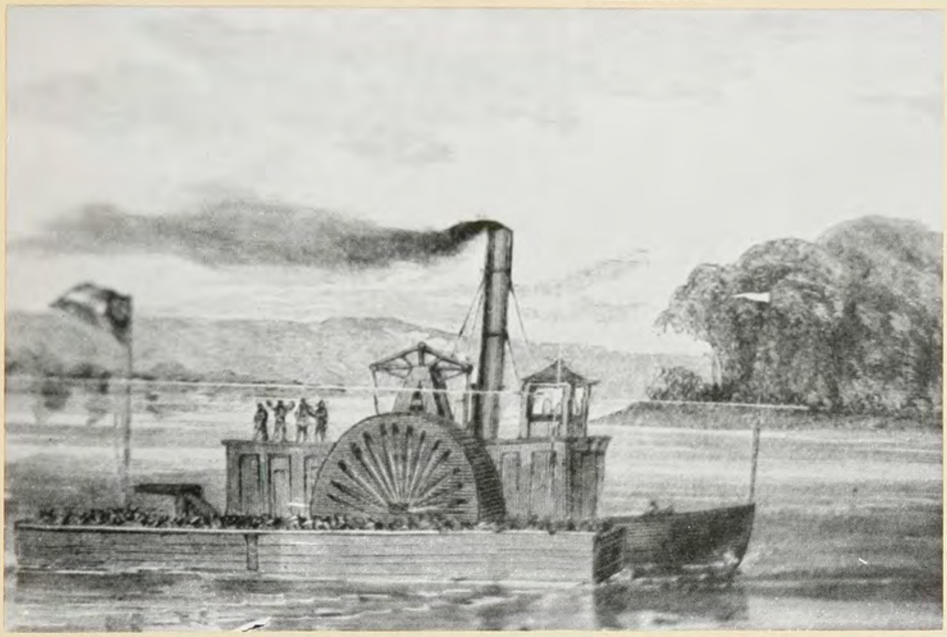


Steamboat *Enterprise* built by Daniel French and Henry M. Shreve in 1814.

But all was not entirely rosy, for gruesome steamboat accidents, so common on the inland waterways, also occurred frequently on the waters of the Cumberland. Although there were many, the best-known steamboat accident on the Cumberland occurred shortly after the beginning of the steamboat trade, in 1821, about eight miles below Eddyville, Kentucky, when the steamboat *General Robertson*, laboring up to Nashville with a full load of freight, exploded, scalding five people to death and blowing two overboard to disappear beneath the rolling waters. The toll of steamboats snagged and wrecked on the rocky shoals of the Cumberland remained quite heavy until the Army Engineers went to work on the river in 1832.[28]

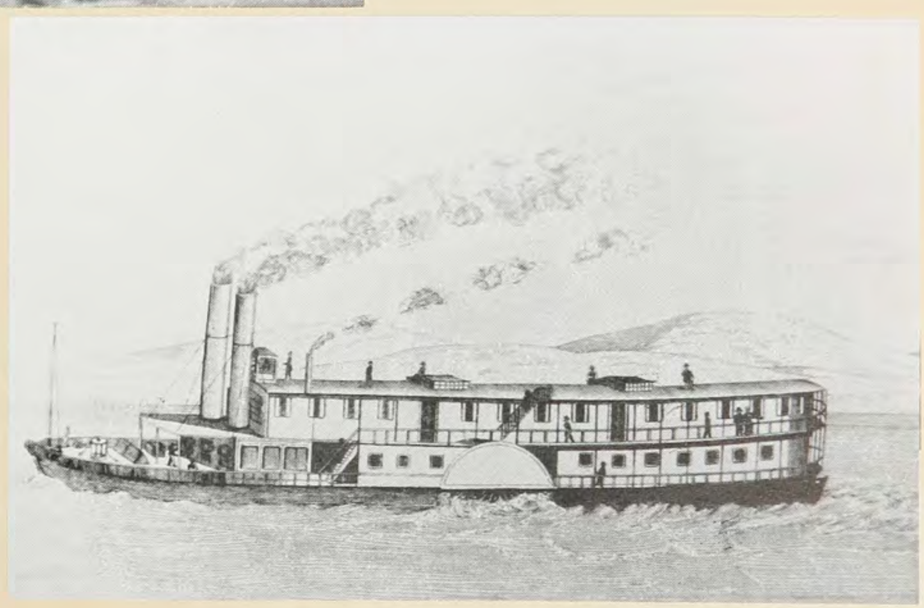
It will be recalled that resistance by the Indians of the Tennessee Valley, especially the Cherokees, and the great hazards to navigation at Muscle Shoals

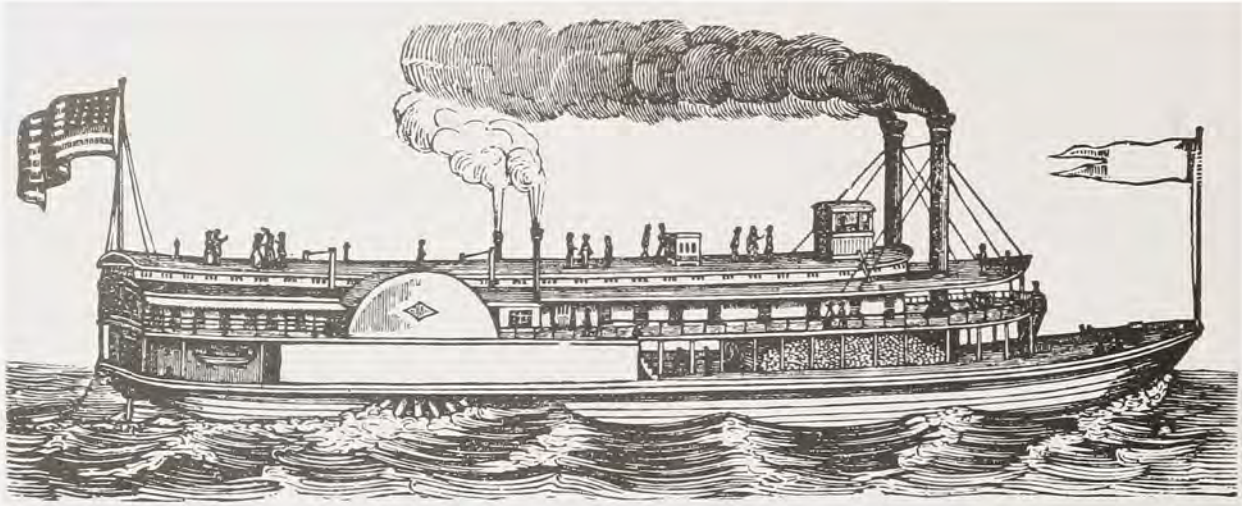
Snags were a major navigational hazard on the unimproved Tennessee and Cumberland Rivers.



Barges were towed at the sides and rear of steamboats before 1850.

Early Sidewheel Steamboat





Early sidewheel steamboat

and the Suck delayed the development of commerce on the Tennessee River. Until the steamboat was placed into commercial operation on western waterways, Knoxville was the largest trading center in the State of Tennessee, but after the advent of the steamboat other Tennessee cities, Nashville and later Memphis, rose to the ascendancy as trading centers. Nashville and Memphis were located on open channel waterways, while Knoxville was not. Although the steamboat did stimulate flat and keelboat traffic on the Upper Tennessee, which floated down river to transfer cargo to steamboats below Muscle Shoals, East Tennessee continued to rely largely on overland trade routes. The citizens of the Tennessee Valley were anxious, however, to acquire the benefits of steamboat navigation and made vigorous efforts to inaugurate steamboat commerce on the river.[29]

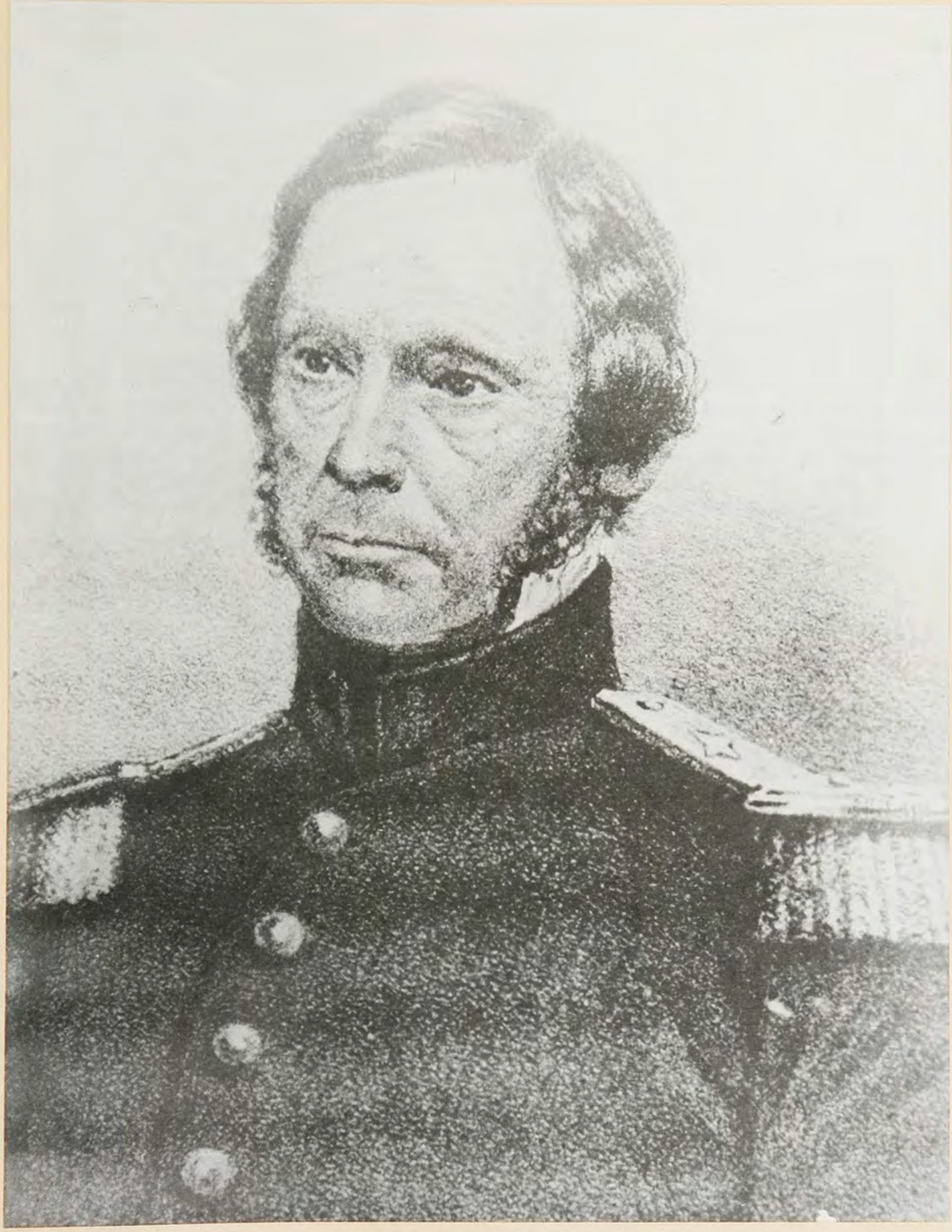
The Alabama and East Tennessee Steamboat Company, founded at Huntsville, Alabama, in 1819, is believed to have financed the first steamboat to reach Florence at the foot of Muscle Shoals in 1821. In March of that year, the *Osage* arrived at Florence laden with a cargo of lead, coffee, nails, sugar, tea, molasses, bar iron, and bagging. It was followed up the river by the *Courier*, the *Velocipede*, and the *Rocket*; the latter inaugurating a regular schedule between Florence and Trinity, Illinois (near the present site of Cairo), on the Ohio, where larger steamers forwarded freight to its destination.[30]

Knoxvillians were especially eager for the extension of steamboat service to their city, and in 1827 they offered a prize of $640 to the first steamer to reach the town. The *Atlas* left Cincinnati to try for the prize and reached Florence in January of 1828. The little side-wheeler worked its way over Muscle Shoals and warped through the Narrows to reach Knoxville in March.[31]

Citizens of Knoxville thought they saw in the *Atlas* the dawn of a new era, but they were grievously in error. The *Atlas* went back down the river, never to return, and the hazards of the Suck and of Muscle Shoals prevented any regular through steamboat service for Knoxville until 1890. Steamboats operated on the Upper Tennessee and on the Lower Tennessee, but Muscle Shoals and the Suck effectively severed commerce on the Tennessee in twain.

Opening the Upper Tennessee Valley to navigation became one of the goals of internal improvement program of the State of Tennessee in 1829. The state organized a Board of Internal Improvements with six members, two for each of the three grand divisions of the state, and $150,000 were appropriated from land sales to fund the improvement program.[32]

Lieutenant Jacob A. Dumeste, a West Point graduate who had aided the United States Army Engineers on several sur-

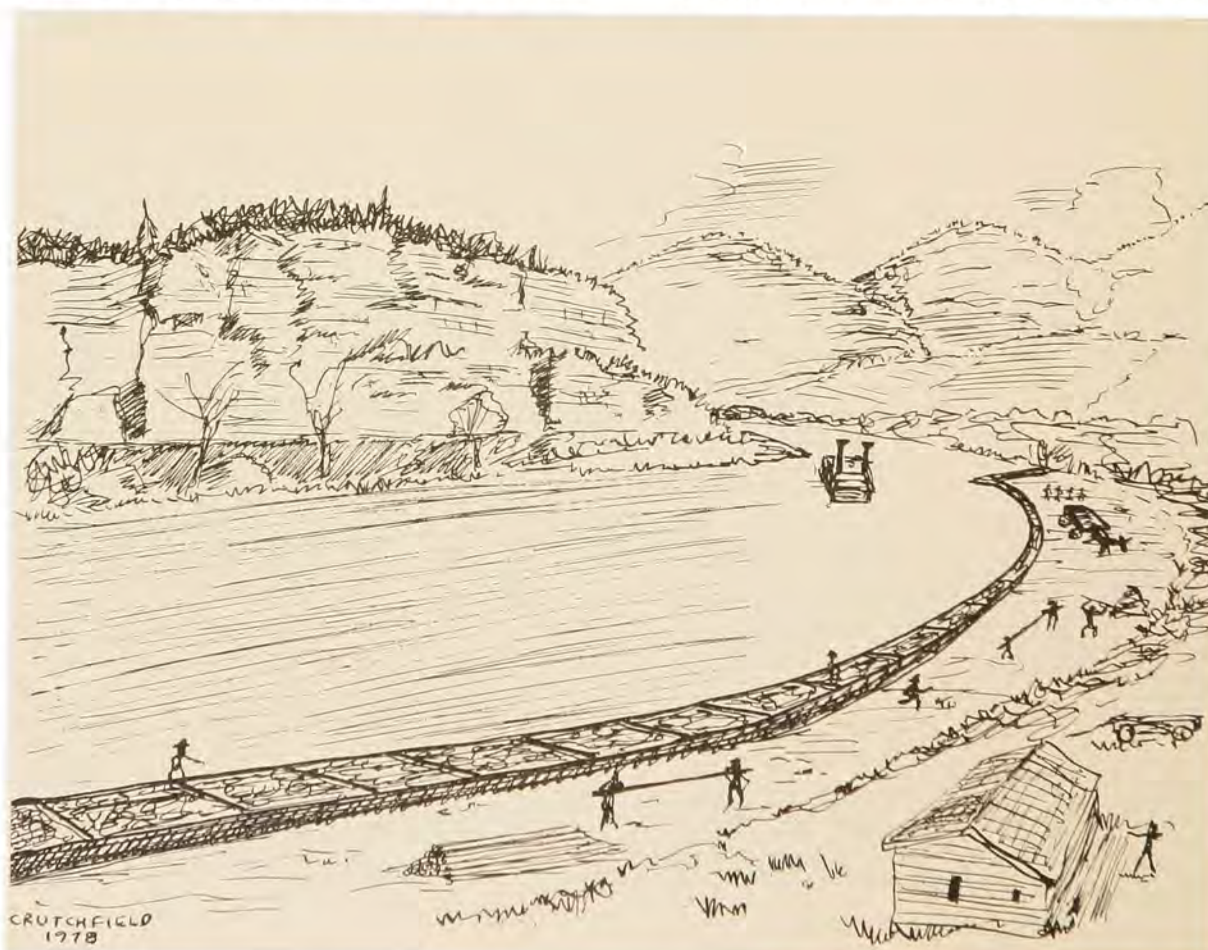


Colonel Stephen H.Long. He surveyed the Upper Tennessee River in 1832 and had charge of the improvement of the Cumberland River in 1839.

veys, was employed by Tennessee to examine the Tennessee River from Knoxville to the Alabama state line, and he reported in 1831 that an estimated $20,000 would remove the worst obstructions from the Suck. His plans were not implemented, however, because sectional jealousies in Tennessee over the manner in which state funds for internal improvements were to be allocated led to the creation of a separate Board of Internal Improvements for East Tennessee. The Board met at Knoxville and requested President Andrew Jackson to send Colonel Stephen H. Long of the Army Engineers, an authority on the improvement of river navigation, to aid in the planning of a project for the improvement of the Upper Tennessee River.[33]

Colonel Long, an officer of the United States Topographical Engineers, was well known in 1832 because of his western explorations, the numerous surveys of roads, railroads, and rivers he had directed, and his experiments with the improvement of river navigation. During his extraordinary career with the Army Engineers, spanning half a century from 1814 to 1864, he became an authority on railroad construction and operation, made several significant improvements in steamboat and locomotive engines, designed a new type of bridge, and had a central role in early Federal waterways projects.[34]

Colonel Long's services were granted free of charge to the Board of Internal Improvements for East Tennessee, his salary constituting indirectly the first expenditure by the United States for the improvement of the Upper Tennessee



Construction of a wingdam on the Tennessee River in 1832.

River, and he traveled to Kingsport, Tennessee, at the head of Holston River, where he met two members of the Board on May 12, 1832. The two men accompanied Colonel Long and his survey party, which consisted of two civilian assistant engineers and three young Army lieutenants, when the survey of the Upper Tennessee was initiated.[35]

The survey party examined the Holston, Nolichucky, and French Broad rivers, then moved down the Tennessee from Knoxville to the formidable Narrows below Chattanooga, where the treacherous whirls of the "Boiling Pot" claimed its first life from the Army Engineers. The surveying party had run a line down the river bank on the sixth of June, quit for the day about five in the afternoon, and waded into the river for a swim. Young assistant engineer Philip R. Van Wyck decided to challenge the foaming eddies of the "Boiling Pot."[36]

Van Wyck swam through the swiftest part of the surging river, but was caught in the vortex below and sucked under. Lieutenant Samuel P Heintzelman heard his cries for help, snatched up a plank for buoyancy, and plunged into the river after him. But too late. Van Wyck's body rose a moment down river, then disappeared beneath the murky waters. It was only after four days of searching that the party found the body of the young and foolish engineer, which the river had cast ashore a mile and a half below the "Pot." They sorrowfully buried him at the spot and marked his grave with a cairn of rough stones.[37]

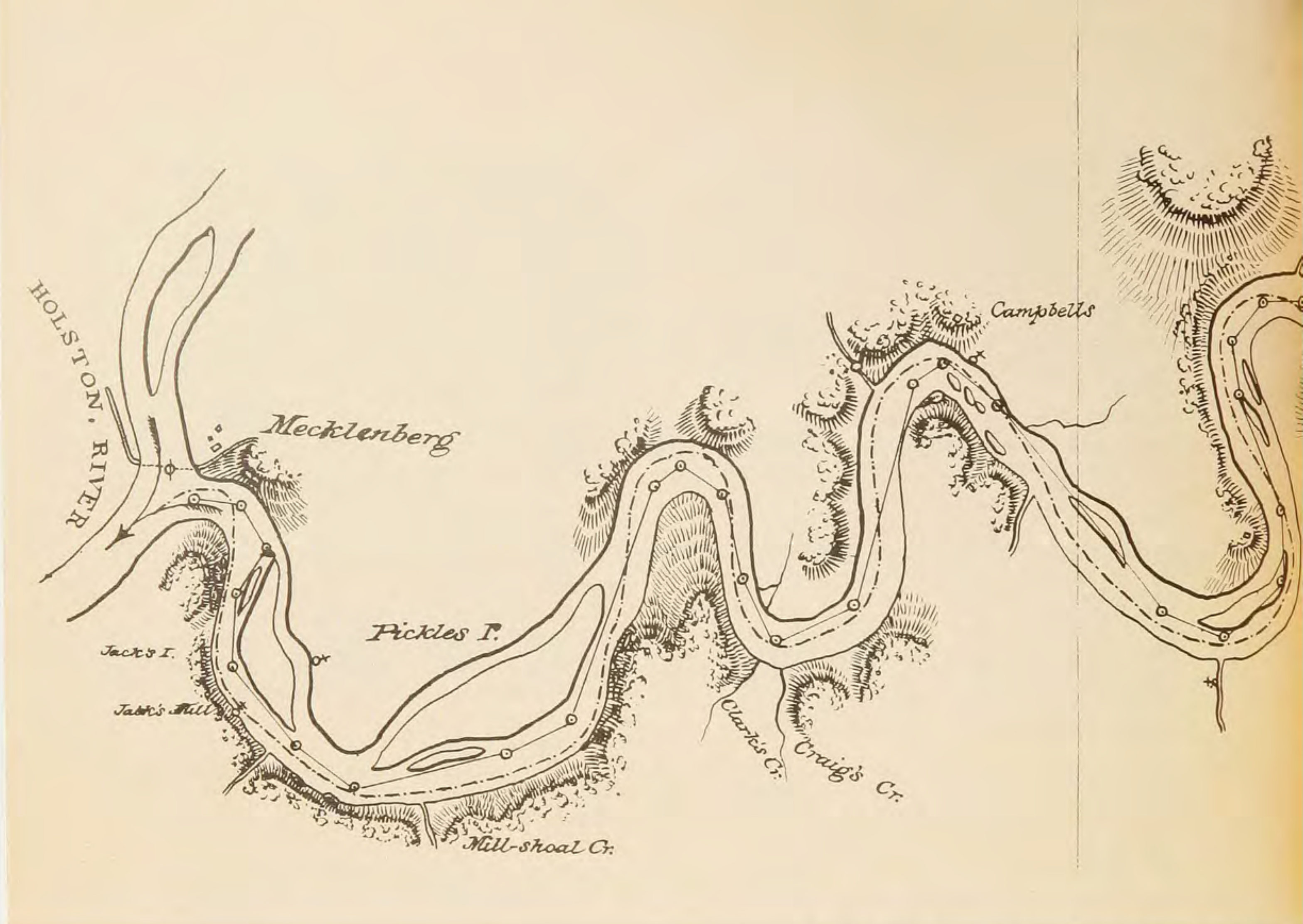
Colonel Long sadly reported the Engineers of the United States had been deprived of a "valuable agent, our company of an amiable and agreeable companion, an extensive circle of friends of one of its most grateful and acceptable members, and a widowed mother of the stay and solace of her declining years." Lieutenant Heintzelman, who had plunged into the torrent after Van Wyck, later distinguished himself in the Mexican, Indian, and Civil Wars, serving as Major General of the the Union Army in the latter conflict.[38]

In his report on the Upper Tennessee River, Colonel Long listed three methods of improving navigation: lateral canals could be constructed parallel to the course of the river; a series of slackwater pools could be created by the construction of locks and dams; or the channel depth could be increased by excavation and facilities for warping installed for the convenience of ascending steamboats. The first two methods were greatly preferable, he declared, but the inadequacy of funds dictated the third method: deepening the channel by excavation in some places and constructing wing dams at other locations to create "a more compact volume and afford a greater depth."[39]

The type dam he proposed was constructed of timbers and filled with bushes, twigs, and stones. Timbers in the dams were to be up to sixty feet long and ten to fifteen inches in diameter, spliced together to form any necessary length and connected by "transverse ties of sawed scantling." The timber framework thus constructed was to be filled with brush and debris weighted down by stones, taking care to lay the largest stones atop the dams.[40]

Such simple dams would cost only about a dollar for each yard of one-foot high dam, Long estimated, doubled for a two-foot high dam to establish minimum channel depth of twenty-four inches at low water. In addition to these simple dams, Long suggested that timber bolsters, or "tori," be anchored to rocks near the channel, especially in the "Narrows," to protect gunwales of passing boats from damage against rocks, and he recommended warping aids, such as ring-bolts, be installed at strategic locations for the convenience of ascending boats.[41]

Colonel Long believed the results of the simple improvements he proposed would be well worth the effort, for in comparing the Upper Tennessee with the Upper Ohio, both of which he had personally examined, he found fifteen inches of water over the shoals of the Tennessee at its lowest stages, which was as great as the Ohio's depth after some improvements had been made. He advised the Board of Internal Improvements for East Tennessee that a depth of twenty-four inches could be obtained on the Upper Tennessee from Knoxville to



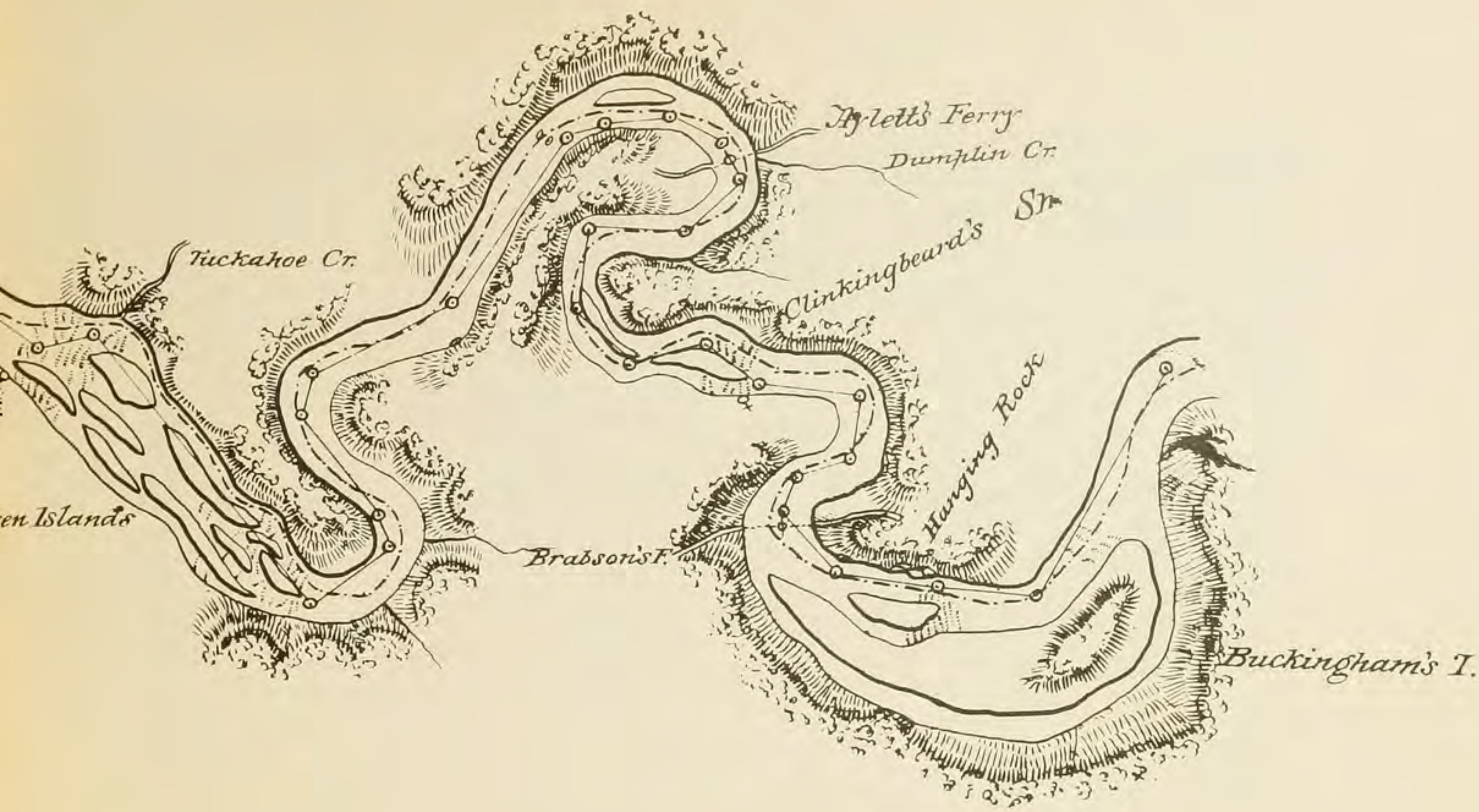
An 1832 map of the lower section of the French Broad River by

the Alabama line at a cost of $58,161.27, but warned that the work should be done with a hired labor force, rather than by contract, because of the "variable and indefinite" character of the work proposed.[42]

The Board ignored Long's last suggestion, however, and advertised for contractors, advising them a "sluice navigation" was proposed which would require rock excavation and a "channel, two feet in depth and *not less* than fifty feet wide will be required at each place proposed to be improved." The Board retained R. P. Baker, an assistant engineer of Colonel Long's survey party, as resident engineer for the project, and the State of Tennessee launched the improvement of the Upper Tennessee River.[43]

Colonel Long's estimate that the sixty thousand dollars available to the Board would be sufficient for the project proved to be in error, for the Board exhausted its funds before the work was completed; perhaps because of its failure to comply with Long's recommendation that it employ hired labor for the work. A member of the Board, Dr. J. G. M. Ramsey, a well known Tennessee historian, commented: "We did the best we could with the means and powers with which we were invested—but as in most cases of river improvements our efforts and expenditures were almost worthless."[44]

Nevertheless, others disagreed with Dr. Ramsey, who was a notable advocate of railways rather than waterways, and thought the work on the Upper Tennessee beneficial. Results were evident in increased steamboat traffic. The steamer *Knoxville* began regular runs from Knoxville to Chattanooga, and J. A. and W. D. Deery Company, merchants of Gay Street in Knoxville, purchased the light-steamers *Cassandra* and *Enterprise*,



eutenant Albert Miller Lea of Major Stephen H. Long's survey party.

placing them on scheduled runs from Knoxville to the head of Muscle Shoals, where cargo and passengers travelled by railroad from Decatur to Tuscumbia, there connecting with steamboats on the lower Tennessee. The little *Cassandra* ran up Holston River from Knoxville to Kingsport, at the juncture of North and South Forks of Holston River, and a few other steamers also made this run, though seldom able to ascend as far as Kingsport. Certainly the work performed on the Upper Tennessee and Holston was durable, for Colonel Long learned in 1843 the dams constructed were working quite satisfactorily; and when the Army Engineers improved the same stretch of river after the Civil War the simple dams built by the State of Tennessee forty years before were still in good condition.[45]

Dr. Ramsey's comments were apropos, however, when applied in general to the efforts of the states to improve the navigability of their rivers. Tennessee's efforts were dissipated by the extension of the improvements to many small streams. In addition to the creation of a separate internal improvement board for East Tennessee in 1831, sectional jealousies within the state led to separate boards for such rivers as the Caney Fork and the Obey; there were even boards of internal improvement established for individual counties.[46]

J. W. M. Brazeale, a political satirist and historian, wrote a burlesque of Tennessee politics in 1842, and his caricature of the oratory of "typical" candidates for public office revealed some of the problems that plagued the state's internal improvement program.[47]

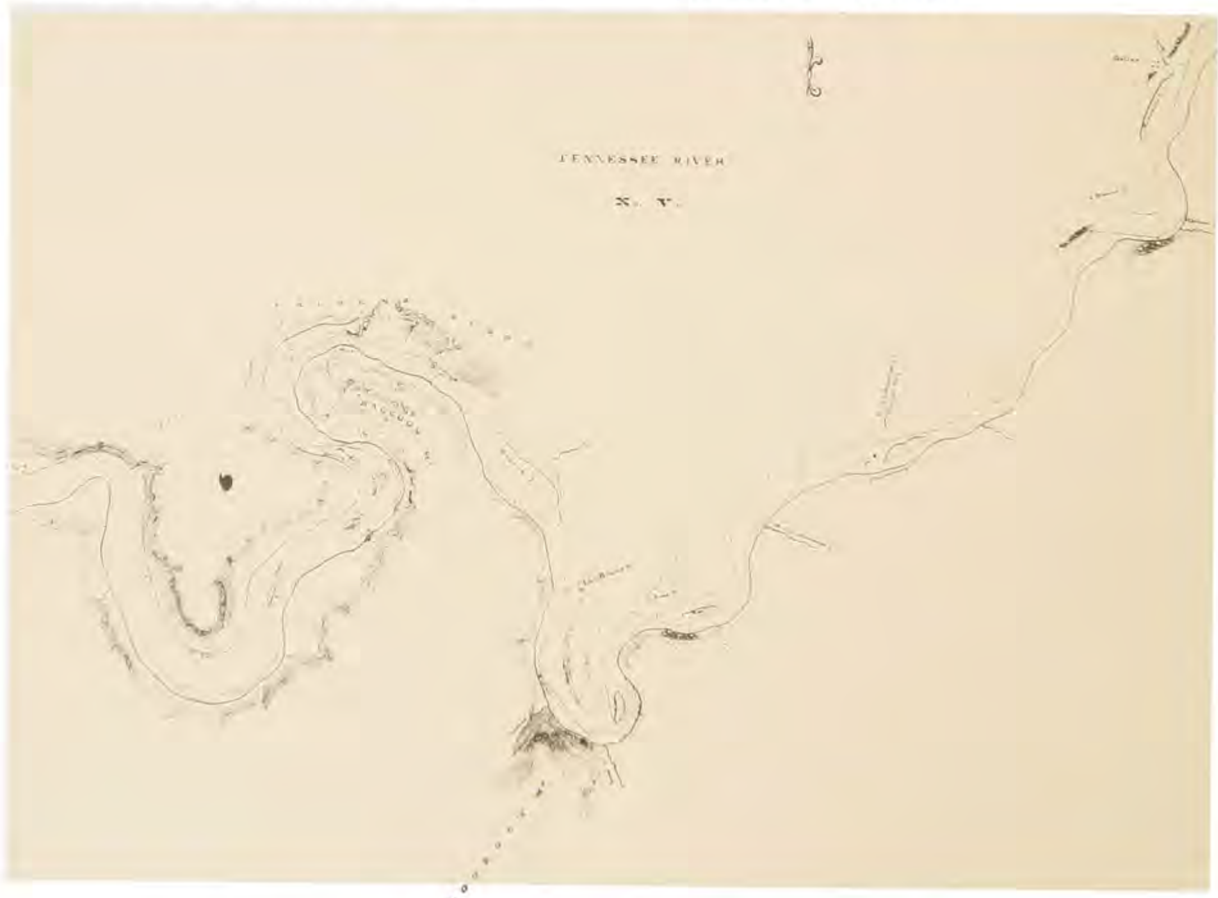
One of Brazeale's political buffoons said in his peroration: "As to public matters, gentlemen, I think we had ort to have the rivers cleaned out; and I don't

want all the money spent on the rivers that runs by the big towns, nether; I want some on it spent on our rivers."[48]

Another, more experienced candidate, gave the voters a candid view of the conflicts in the state legislature over internal improvements: "As to the internal improvement talked about, by my honorable opponent, . . he mout as well talk about improvin the river Nile. I have bin to the legislator, gentlemen, and I know how this improvement bisniss works. When I ax for money to improve Tennessee river, every feller in the whole legislator wants some too to improve some branch or creek in his county; and there aint money enough. . ."[49]

"Aint money enough" and the dissipation of the funds which were available characterized the attempts of the State of Tennessee to improve its waterways. In 1838, Tennessee authorized the sale of bonds totaling $300,000 for river improvements, but the national depression which began in 1837 made marketing the bonds difficult and few improvements of consequence resulted. The State appropriated more funds in 1842 for river improvement in East and West Tennessee, omitting Middle Tennessee where the Federal government had improved the Cumberland, but the funds, scattered over many streams, were expended with little beneficial effect.[50]

State governments in the twin valleys continued to charter private companies that proposed to improve river navigability throughout the first half of the nineteenth century, but few of these firms actually completed any improvements. One promising project was begun on Duck River in 1851 that proposed to furnish slackwater navigation on the stream from its juncture with Tennessee River up to Columbia, Tennessee, a distance of 133 miles.



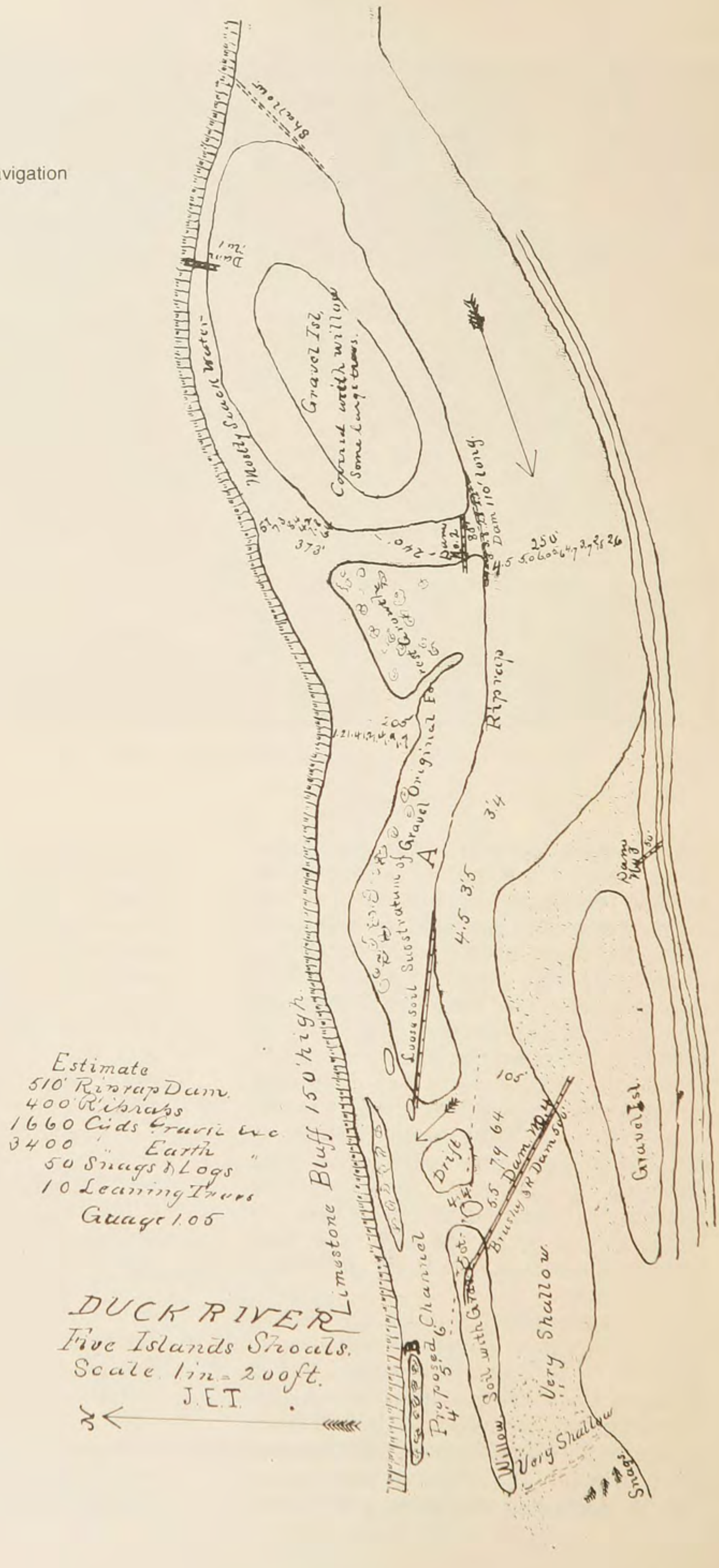
Major Stephen H. Long's 1832 map of the Tennessee River at Chattanooga.

Warping up through the "Suck" below Chattanooga.

Flatboats laden with cotton descended Duck River from points above Shelbyville, Tennessee, enroute to New Orleans; keelboats operated to Columbia on Duck River at an early date; and steamboats also reached Columbia at rare intervals. The steamboat *Madison*, Captain Lamb, arrived at Columbia in March, 1839, creating quite a sensation at the port. The *Madison* was a hundred feet long, twenty-two feet wide, and drew only three feet with a full freight. In October of the same year, goods were delivered to Columbia stores by the steamboat *Constellation* out of New Orleans, though it is not clear the boat actually ascended Duck River all the way to Columbia.[51]

Civic leaders of Columbia and Maury County organized several companies to improve Duck River navigation, and in 1850 the Duck River Slackwater Navigation Company secured $250,000 in stock subscription pledges, plus $20,000 provided by a City of Columbia bond issue. The company had employed a Mr. Drury to survey the Duck River and plan the slackwater project. Mr. Drury reported nine low locks and dams would supply slackwater to Columbia for steamboat navigation. The company purchased 82 slaves, employed skilled labor, and began construction of the two locks and dams nearest Columbia in early 1851. With the project underway, the company employed Sylvanus Lothrop, a distinguished civil engineer, and Lieutenant Achilles Bowen, formerly of the Army Engineers, to survey the lower Duck and prepare detailed project designs. These engineers determined that Mr. Drury had made an important error in computations—the fall of Duck River from Columbia to its mouth was double the figure calculated by Mr. Drury, whose mathematics were faulty. Lothrop and Bowen designed higher locks and dams, but the increased costs of the project frightened the stockholders, who brought suit against the company and terminated the project. The two completed locks and dams, low wooden

1882 plans for the improvement of Duck River navigation at Five Island Shoals.



rock-filled structures, were abandoned and had been destroyed by floods by 1879.[52]

Practically all state and private projects for river improvement were undertaken in the interest of navigation, with little thought given to other purposes which river improvements might serve, but there was at least one interesting exception.

At Nashville, a group of citizens met in 1841 to discuss a project that involved construction of a canal and lock and dam at Lewis Bottom above the city to aid navigation and to create water power for manufacturing, a project which might today be called "multipurpose." Albert Stein, a civil engineer who had designed the Nashville waterworks system, surveyed the proposed project and reported it was practicable, and a committee was formed to memorialize the legislature on the subject.[53]

Stein estimated the cost of the project at only $150,000, but the work was never undertaken; it continued, however, to excite some interest in Nashville for years thereafter. The Nashville *Daily Gazette* boosted such a project in 1850, observing it could serve several purposes: bring in revenue from tolls on lumber and coal passing through from the Upper Cumberland, produce water power for manufacturing, and reduce the damage caused by the annual floods on the Cumberland.[54]

"At all events," said the *Daily Gazette*, "some means should be employed to arrest the annual destruction of property, and the distress and misery which attends these overflows. And he who shall devise a plan . . to prevent these annoyances and losses, will deserve the thanks and gratitude of future generations."[55]

The agency which eventually accomplished this humanitarian mission, the Corps of Engineers, United States Army, was at work on the nation's waterways in 1850 when the *Daily Gazette* editorialized on the necessity for flood control. Its history had actually begun just two months after the "shot heard round the world," when the Continental Congress authorized the commissioning of Engineers in the American Army on June 16, 1775.


ESSAYONS
T. E.
ESSAYONS

CHAPTER III

THE ENGINEERS AND THE SOUTHERN ROUTE

Throughout the long night of June 16, 1775, Richard Gridley, America's first Chief Engineer, directed the fortification of Breed's Hill for the New England Provincial Army. Gridley, like Thomas Hutchins who first mapped the twin rivers, had gained his engineering experience in the service of the King during the wars with the French.[1]

In June of 1775, Colonel Richard Gridley was no longer in the service of the King, and, instead, was preparing to welcome the King's soldiers with a deadly embrace. After fortifying Breed's Hill, he remained in the trenches during the combat of the next day—the battle known as Bunker Hill—in which he was wounded. A month later he was appointed Chief Engineer of the Continental Army.[2]

Colonel Richard Gridley was first of a long line of colorful and distinguished officers who have served as Chief Engineer (later Chief of Engineers) of the United States Army. In the demobilization which followed the American Revolution the Corps of Engineers was disbanded, but Congress established another Engineer organization in 1794, the Corps of Artillerists and Engineers. This composite Corps did not provide adequate training for its personnel and proved unsatisfactory; hence, Secretary of War James McHenry pressed upon Congress the necessity for providing for the training of competent Army Engineers, pointing out the value which trained engineers might also have in the construction of civil works.[3]

McHenry observed in 1800 that the special abilities of the Army Engineers could extend from works of military necessity to "public buildings, roads, bridges, canals, and all such works of a civil nature." This line of reasoning contributed to the creation of the present Corps of Engineers during the administration of President Thomas Jefferson. On March 16, 1802, Congress stationed a Corps of Engineers at West Point to constitute the United States Military Academy. (The Academy remained under the jurisdiction of the Corps of Engineers until 1866).[4]

Not long thereafter, officers of the Corps of Engineers were dispatched to survey the frontiers, to examine the routes of roads, canals, and to plan other internal improvements; thus establishing the policy of employing the talents of the Army Engineers in the planning, construction, and operation of civil works, or, as then more commonly known, internal improvements.

During the half century before the Civil War, Army Engineers surveyed and built roads and railroads, examined and improved waterways, constructed lighthouses and fortifications on the nation's seacoasts, and erected many hospitals and forts across the nation. The Corps of Engineers was joined in these pioneer civil works by the Topographical Engineers, and both engineering organizations were active in the Cumberland and Tennessee valleys. In these two valleys, the efforts of the Engineers were aimed largely at improving the navigation of the rivers by surveying, mapping, designing, and executing projects designed to aid the movement of a burgeoning waterways commerce.

From the very beginning, the Army Engineers, as representatives of the national government, were embroiled in political conflict, which seriously ham-

pered their efforts to improve the rivers, for the power of the Federal government to construct internal improvements—road, railroad, canal, and waterways projects—was a divisive political issue in the nineteenth century.

Before 1824, the activities of the Federal government in the area of waterways improvement was limited largely to the installation of safety devices, such as beacons, buoys, and lighthouses, although a few minor navigation improvements were made in seacoast harbors. The first official recommendation that the Federal government undertake a national program of internal improvements came during the Jefferson administration, from Albert Gallatin, the Secretary of Treasury.[5]

Gallatin believed only the Federal government possessed the resources necessary to carry out a program designed to open a system of national communication and transportation, "No other single operation," he said, "within the power of Government, can more effectually tend to strengthen and perpetuate that Union which secures external independence, domestic peace, and internal liberty."[6]

Gallatin therefore recommended a national canal network to bind the sprawling young nation together—a network which projected a system of canals running north and south along the Atlantic seacoast while others crossed the Appalachian mountain chain to the inland rivers. His report contemplated the construction of canals to connect seacoast ports, such as Savannah, Charleston, and Mobile, with the waters of the Tennessee River and, thereby, the entire inland waterways system. In short, the vision of Albert Gallatin, as reflected in his report on internal improvements, was prophetic, but his far-reaching proposals were ahead of their time and were not then implemented by Congress.[7]

After the nation passed through the crisis of the War of 1812, the visions of Gallatin were revived by President James Monroe's Secretary of War, John C. Calhoun of South Carolina, who, being instructed to prepare plans for "the more complete defence of the United States," proposed an extensive system of internal improvements similar to that proposed by Gallatin a decade before.

The plan involved construction of roads and canals which, said Calhoun, were "precisely those which would be required for the operations of war." It will be recalled the United States was invaded on several occasions during the course of the War of 1812, most notably by British forces which struck into the interior via water routes at Lake Champlaign, Chesapeake Bay, and the Mississippi River, and concentrating American forces to meet the invaders had proven to be most difficult; indeed, the effort had failed in Maryland and the nation's capital was burned. Sounding almost like a modern military strategist, Calhoun continued: "It is in a state of war, when a nation is compelled to put all its resources in men, money, skill, and devotion to country into requisition, that its Government realizes in its security the beneficial effects from a people made prosperous and happy by a wise direction of its resources in peace."[8]

Calhoun therefore recommended that Congress direct the necessary surveys and estimates for the internal improvement system be made by the "able military and topographical engineers" of the United States Army, with the assistance of skillful and experienced civil engineers. This would, Calhoun assured Congress, insure the complete efficiency of the system when construction was completed.[9]

On April 30, 1824, Congress authorized President James Monroe to proceed with a program of internal improvements of national significance (the General Survey Act), with the Army Engineers charged with preparing the necessary surveys, plans, and estimates. This was followed on May 24 by the first Rivers and Harbors Act which provided for the improvement of navigation on the Ohio and Mississippi rivers by the removal of sand bars, the clearance of the timber-covered banks, and the raising of "planters, sawyers, or snags" from the channels.[10]

The United States thus embarked in 1824 on a program of internal improvements—civil works—which, though interrupted on several occasions prior to 1866 by political opposition, was eventu-

ally to extend to all parts of the nation and overseas to territories and dependencies, with the Army Engineers designated as the organization which would implement the program.

Travel on the western inland rivers was exceedingly dangerous when the Engineers first began their efforts to improve navigation. Since the early efforts of the states had resulted in few permanent improvements, the first work of the Engineers was experimental; no one had discovered the most effective ways of improving navigation or had any idea of what the cost of procuring a safe and certain navigation on wild western rivers would be.

One of the first experiments with methods of improving rivers was executed by Colonel Stephen H. Long on the Ohio River near Henderson, Kentucky, in 1825. Colonel Long constructed a simple wing dam, perhaps the first installed on the mainstream of a western river for purposes of channel improvement and certainly the first built by the Army Engineers, to confine the current of the Ohio to a narrower portion of the river bed, thereby increasing the water's velocity and scouring away a sand bar by the action of the river itself. The experiment proved successful and was emulated on many other inland waterways; indeed, wing dams were still occasionally used by the Corps of Engineers in 1975.[11]

The War Department also offered a prize of $1,000 to the individual who submitted the best suggestion for the removal of treacherous snags deeply embedded in the channel of practically every western river, the Cumberland and Tennessee included. The prize was awarded to John Bruce of Kentucky for a floating rig he designed which had twin, parallel hulls about eight feet apart tied together by traverse timbers. These rigs became known as "machine boats," though there was little machinery connected with their operation; they were propelled by hand and they wrenched snags from the river bottom by the manual operation of windlasses mounted on the traverse timbers between the two hulls.[12]

The inventor of the machine boat, John Bruce, contracted with the War Department to remove the snags from both the Ohio and Mississippi rivers for a fee of $60,000. Machine boats were built at Pittsburgh and Bruce began clearing the Ohio River channel, under the supervision of an Engineer officer, but he soon found that his invention was inadequate for the task. Bruce's contract was terminated and an agent was appointed to continue the work, but the agent died a short time later and the task devolved on the broad shoulders of the famous western steamboatman, Henry M. Shreve.[13]

Captain Shreve, with the title "Superintendent of Western River Improvements," set about his new duties with his customary celerity and requested authority to build an experimental steam-powered snag-boat he had designed. The War Department, chary of investing $12,000 in an untried machine, ordered him to continue the improvement of the rivers with flatboats and manual labor for a time, but eventually authorized the experiment and Captain Shreve launched his snag-boat, the *Heliopolis*, in 1829 at New Albany, Indiana.[14]

The *Heliopolis* was twin-hulled, like Bruce's machine boats, with the hulls spaced eleven feet apart and connected at the bow by iron-plated timbers, forming an "M" shaped wedge at the waterline. The vessel was designed to build up a head of steam and ram the troublesome snags headon, catching them in the middle of the "M" and smashing them free from the river bottom. Once a snag was broken loose from its mooring, it was hauled aboard the boat and sawed into convenient chunks to feed the boilers of the steam engine. The craft was further equipped with a heavy chain tied to the bows of the twin hulls and trailing in the water below to catch sawyers beneath the water's surface and snap them free.[15]

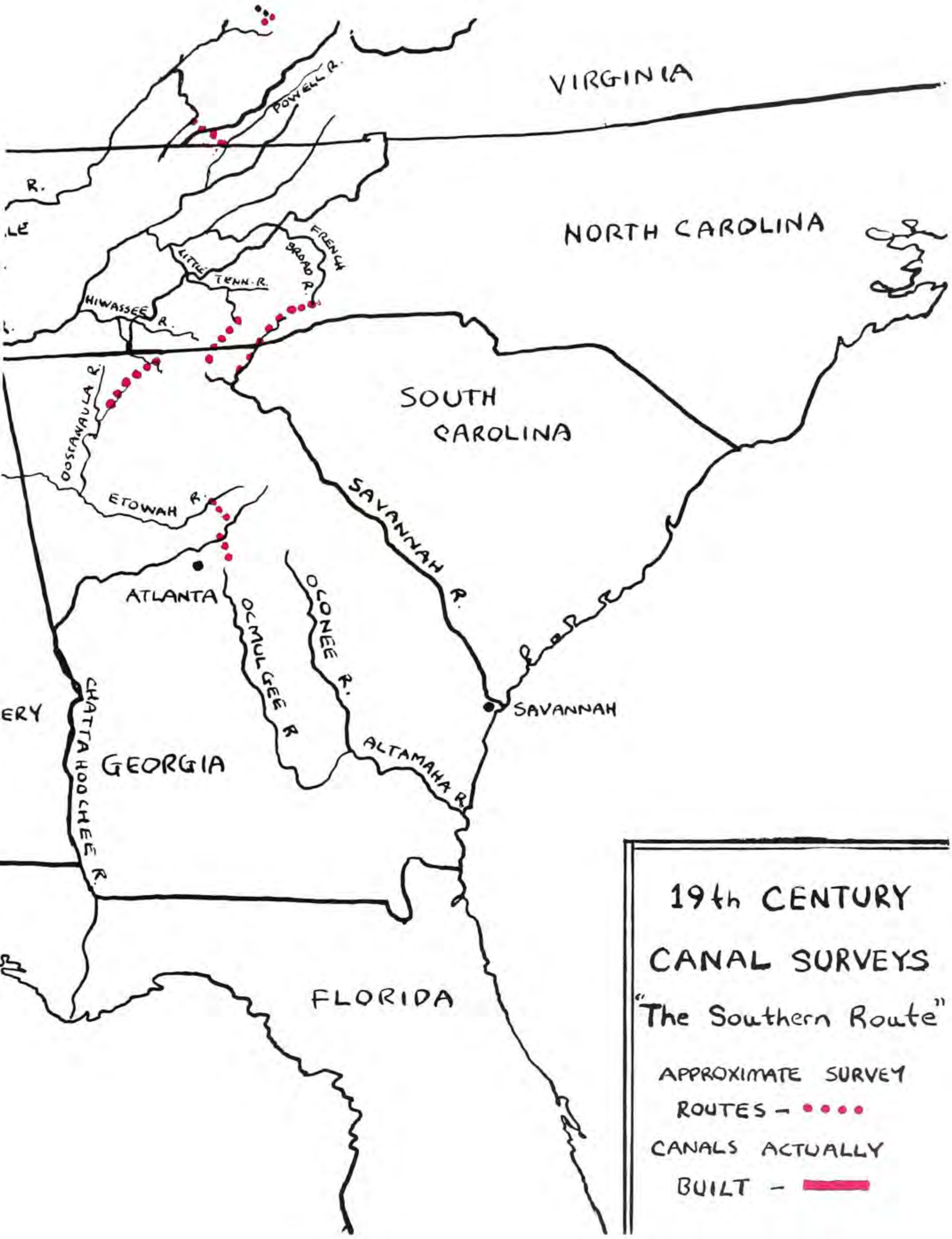
Shreve took the *Heliopolis* down the Ohio, past the mouths of the Cumberland and Tennessee, to the Grand Chain of Rocks, where his men were blasting out a safe channel and constructing a wing dam to overcome those dangerous obstructions, picked up a work crew, and ran the boat down to a snag-ridden section of the Mississippi known as Plum

Point. There, he tested and proved the value of his invention by smashing the river clear of snags, and subsequently other similar snag-boats were constructed to execute the great work at hand; one of them, the U. S. E. D. *Laurel*, was eventually put into snagging operations on the Cumberland River. The effect of snag clearance was almost immediate. From 1822 to 1827, losses on the western rivers caused by snags alone amounted to $1,362,500, but the work of the Engineer Department and its agent, Captain Shreve, reduced the losses to less than $381,000 from 1827 to 1832, and in the latter year not a single boat was lost as a result of hitting a snag.[16]

The experiments which Colonel Stephen H. Long had conducted with river improvement on the Ohio River were extended to the Tennessee in 1832 when he went there at the invitation of the Board of Internal Improvements for East Tennessee to plan the state's improvements on the Upper Tennessee River. Captain Shreve's operations on the Ohio and Mississippi rivers were extended to the Cumberland in 1832, by direction of Congress. But before examining the activities of the Army Engineers on the Cumberland River after 1832 the nebulous, enticing visions of a "Southern Route" and the Army Engineers' involvement in those dreams should be reviewed.

The vision of a "Southern Route," an integrated system of rivers and connecting canals which would divert commerce, both east-west and north-south traffic, through the Cumberland and Tennessee valleys in the Central South, has existed for nearly two centuries. The outlines of the dream have altered considerably, however, since Zachariah Cox, the founder of Smithland at the mouth of the Cumberland River, was first struck, in 1785, by the "practicability of a Commercial Communication by way of the Mobile and Tennessee"; that is, by the possibilities of a transportation route similar to the Tennessee-Tombigbee Waterway of today.[17]

Zachariah Cox, a native of Georgia, became interested in organizing a settlement near Muscle Shoals on the Tennessee River in 1785, and after acquiring


VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
POWELL R.
FRENCH BROAD R.
LITTLE TENN. R.
HIWASSEE R.
OOSTANAULA R.
ETOWAH R.
ATLANTA
OCMULGEE R
OCONEE R.
SAVANNAH R.
SAVANNAH
ALTAMAHA R.
CHATTAHOOCHEE R.
19th CENTURY
CANAL SURVEYS
"The Southern Route"
APPROXIMATE SURVEY
ROUTES -
CANALS ACTUALLY
BUILT -

a land grant from Georgia of three and a half million acres in North Alabama he dispatched a party of eighteen men to build a fort at Muscle Shoals. But the Indians, whose claims to the region had not been extinguished by treaty, threatened the work-party and the projected settlement was abandoned.[18]

Cox, nevertheless, refused to give up the venture, even though the Federal government opposed the project for fear that it would lead to Indian troubles, because Cox was convinced that the centrally located Muscle Shoals region had a great future. "It is certain," said Cox, "for many years, the exports will pass down the river Mississippi—but the imports, if the avenue was admitted to be opened, would now pass by way of Mobile and Tennessee—and the various streams with which the latter communicates."[19]

Cox organized the Mississippi and Mobile Company in 1797 to develop a trading route from the Cumberland and Tennessee valleys down the Alabama rivers to the Gulf of Mexico at Mobile, and planned headquarters for the company "on the southeast side of the Ohio, between the River Cumberland and Tennessee. . ." He dispatched John Smith (from whom Smithland, Kentucky, presumably derives its name) to lay out a town, and then followed Smith, leading a party of settlers from East Tennessee across Kentucky to the Falls of the Ohio (Louisville) and then down the Ohio by boat, arriving at Smithland on February 18, 1798.[20]

After the settlement was secure, Cox set out down the Ohio and Mississippi to New Orleans and Mobile, which in 1798 was the territory of Spain, to establish trade relations with the Spanish settlements, presumably planning to open the Mobile to Tennessee route. He and his party of eighty men were stopped, however, by Major Jacob Kingsbury in command of troops at Fort Massac on the Ohio, who threatened to open fire on the party with every piece of ordnance in the fort, because he had orders not to let armed parties pass down the river toward Spanish territory.[21]

Only after Cox had disarmed his band was he allowed to pass by Fort Massac, and when he finally reached Spanish territory he was not well received at all. In fact, he was seized and imprisoned for a time and found no interest in trade relations whatsoever. He and his party walked back north through Indian country to Nashville, his hopes for a trade route destroyed. Not until after 1816, when a treaty with the Indians opened the Muscle Shoals region of North Alabama to settlement, did trade from the twin valleys to Mobile develop, and it was not extensive, but the obvious logic of Cox's dreams continued to be persuasive.[22]

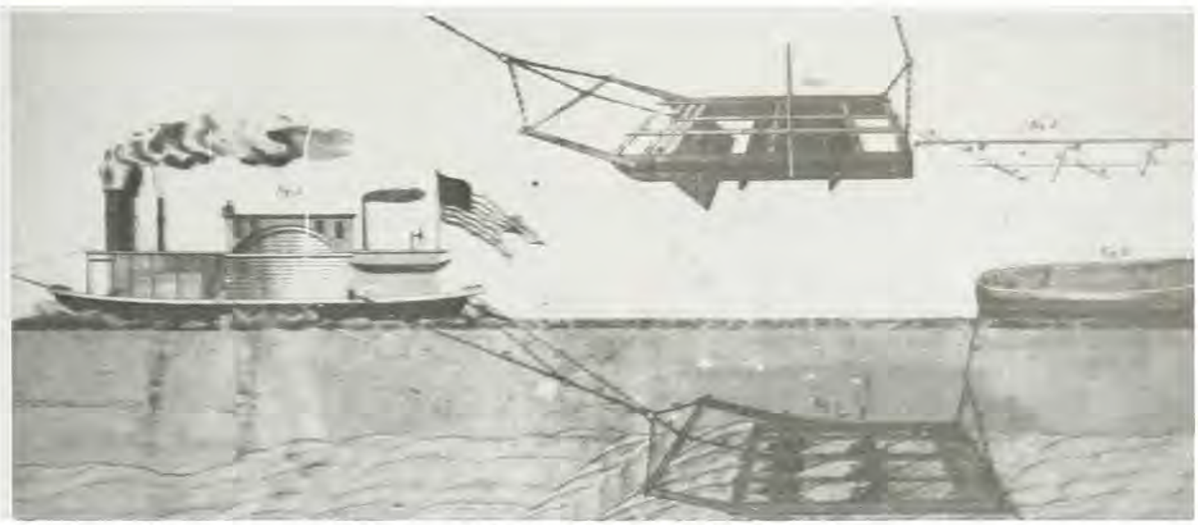
Lorenzo Dow, an evangelical minister, traveled from Tennessee to Alabama in 1803, carrying the gospel to the hinterland, and the trip led him to the conclusion that the Tombigbee River of Alabama "will one day become the glory of the south part of the United States, as the trade of Tennessee, &c., will pass through it."[23]

In 1807, citizens of Tennessee and Georgia petitioned Congress for authority to improve the navigation of the Muscle Shoals, to build commercial establishments on the headwaters of the Tombigbee River, and to build and use roads through the Indian territory. A "Smith County Farmer" of the Cumberland River settlements seconded this proposal in a letter to the editor of a Nashville newspaper:

> A proper attention to the interest of this country would dictate not only the opening of a road, but the connecting of the waters of Bear creek, a branch of the Tennessee, with those of Tombigbee, by canals and locks, an object not only practicable, but easily attained if properly attempted.[24]

Similar observations by a "Friend to internal improvements, Tombigby settlement" were addressed to the Tennessee legislature in 1809:

> To the state of Tennessee one great object most impressively presents itself.— The junction of the waters of the Tennessee with those of the bay of Mobile, must not only be productive of the highest convenience to the inhabitants of your state, but will render your state the great throughfare for importations from the Gulph of Mexico to the western portion of the American empire. The circuity of the route of the Mississippi, and the rapidity of its current,



1825 Engineer channel dredge.

render it extremely desirable that another channel be established; and happily, the Tombigby furnishes a most eligible one to the people of western Tennessee. . .[25]

Thus was born the vision of the Southern Route, the tantalizing dreams of an interconnected Southern waterway system, which as years passed became more grandiose in scope. Support, for example, developed for the construction of a canal between the Cumberland and Tennessee rivers as part of the system and also for a canal from the Tennessee River to the Big Hatchie River, near Bolivar, Tennessee, which flows into the Mississippi above the present site of Memphis.[26]

The Board of Internal Improvements of the Commonwealth of Kentucky envisioned a canal system which would compete with the Northern Route (Erie Canal), involving, among other features, a canal constructed between the Kentucky River, tributary of the Ohio, and the Cumberland River at Cumberland Ford (Pineville, Kentucky).[27]

This proposed canal was only the northernmost link in an elaborate waterways network designed to bypass the Appalachian mountain chain. From Pineville, the route ran up the Cumberland a few miles to the mouth of Yellow Creek, up Yellow Creek to the present site of Middlesboro, Kentucky, via a canal in the bed of the creek, then through Cumberland Gap by a tunnel and by canal into Powell's River, down that river into the Clinch and Tennessee rivers, then up the Hiwassee River by locks and dams, over to the head of navigation on the Savannah River by canal, and finally down the Savannah to the Atlantic.[28]

Like Tennessee, Kentucky, and Georgia, the State of Alabama, after it entered the Union in 1819, was also intrigued by the concept of a Southern Route for commerce. Of course, it was most interested in the leg of the route which would divert the commerce of the twin valleys to Mobile via the Alabama rivers, but it also supported the connection of the Tennessee River with the Altamaha River system which drains into the Atlantic.[29]

Hence, the Southern Route, as envisioned in the nineteenth century, was a nebulous concept, with different forms in several states, but basically the aim of those who visualized such a waterways system was the same. They hoped to divert the commerce of the Upper Mississippi Valley, the Ohio River Valley, and the Cumberland and Tennessee valleys from the serpentine, meandering course of the Mississippi River to shorter routes via the Alabama rivers to the Gulf at Mobile, or via the rivers of Georgia to the Atlantic.

It will be recalled that the General

Survey Act of 1824 authorized the President to direct the execution of surveys, plans, and estimates necessary for internal improvements of "national importance." This act was encouraging to the proponents of the Southern Route, because, under the provisions of the act, the Army Engineers were ordered to survey the various canal lines which were proposed. To direct the national transportation program, the War Department organized the Board of Engineers for Internal Improvements, with three outstanding engineers as its original members: General Simon Bernard, Colonel Joseph Totten, and John L. Sullivan.[30]

General Simon Bernard

John L. Sullivan was an experienced and prominent civil engineer; Colonel Joseph Totten served in the Corps of Engineers for fifty-nine years, twenty-six of them as Chief Engineer; and General Simon Bernard was a Frenchman who once served as Engineer in Emperor Napoleon Bonaparte's army. After the disaster at Waterloo in 1815, General Bernard fled France to the United States with a recommendation from America's great friend and hero, the Marquis de Lafayette, and was appointed to the Corps of Engineers with the rank of Brigadier General. He eventually returned to France in 1830, after the fall of the Bourbon monarchy, to serve as Minister of War to Louis Philippe, the "Citizen King."[31]

These three men, and subsequent members of the Board of Engineers for Internal Improvements, developed a comprehensive national program of internal improvements, involving construction of a network of national roads and canals; among the latter were a canal around Muscle Shoals of the Tennessee River and canals connecting the Tennessee with rivers emptying into the Atlantic and Gulf of Mexico—the Southern Route.[32]

In 1827 the Board's investigation of portions of the Southern Route began, and four survey parties were put into active field operations, examining Muscle Shoals, the Tennessee-Mobile route, the Tennessee-Savannah route, and the Tennessee-Altamaha route.

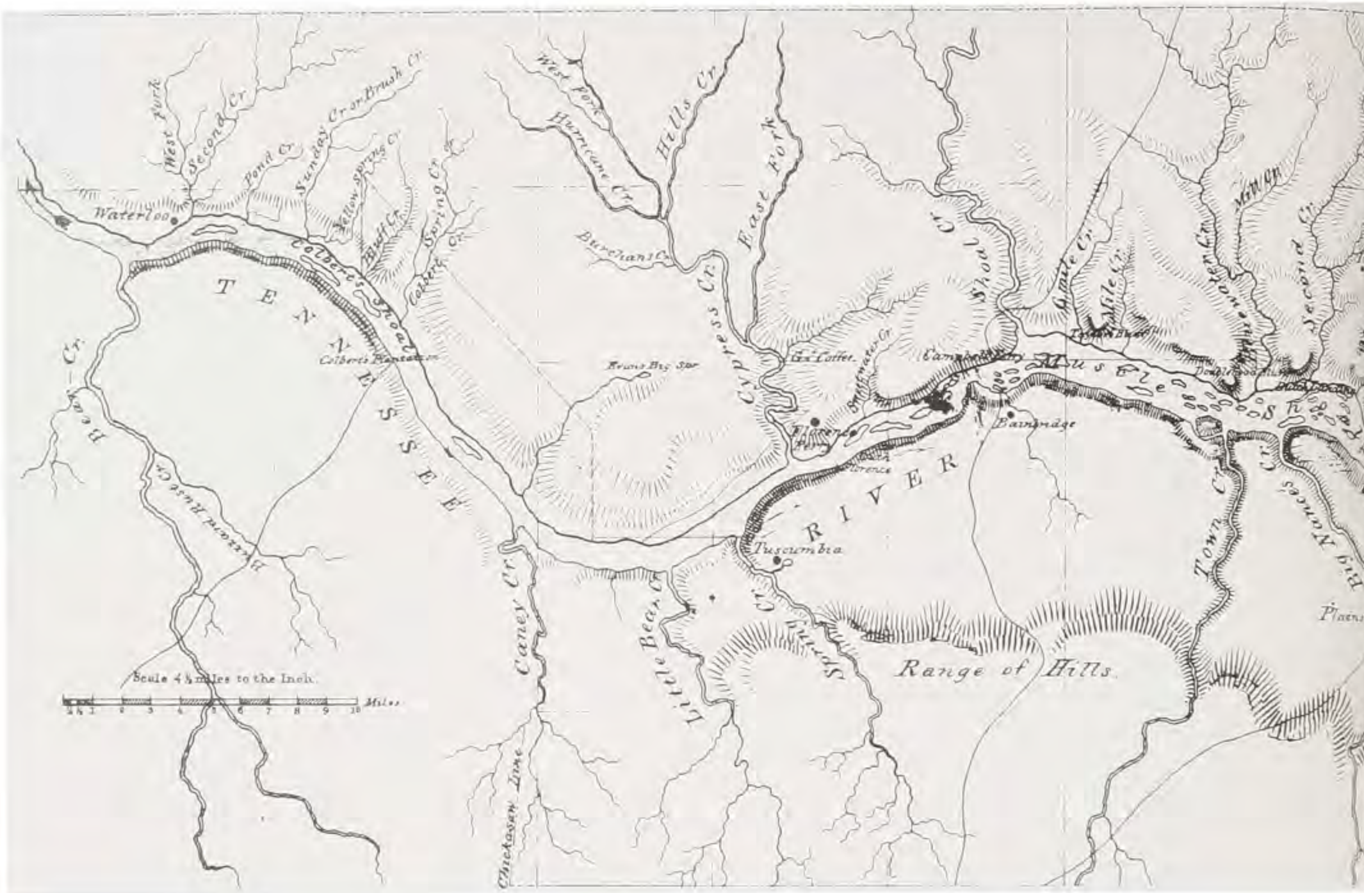
William Jerome, United States Assistant Engineer, surveyed the route from the Tennessee Valley to the Atlantic via the Altamaha River of Georgia in 1828 and 1829. He discovered the heights between the headwaters of the Tennessee and those of the Altamaha made the route extremely difficult and expensive, but reported that construction of a connecting canal or railroad was at least feasible.[33]

Captain Hartman Bache, a great-grandson of Benjamin Franklin and Topographical Engineer, examined the possibilities of a canal connecting the Tennessee Valley with the Atlantic via the Savannah River in 1828. Captain Bache's party surveyed two alternative routes for canals to the Savannah River: one from the headwaters of the Little Tennessee River, the other from the headwaters of the French Broad. Captain Bache concluded that both proposed routes were feasible and that the project should be given high priority, because it would relieve the citizens of the Upper Tennessee Valley from the dangers of navigating Muscle Shoals and the expenses of wagon trade across the Appalachian Mountains.[34]

The third leg of the Southern Route, from the Tennessee Valley to Mobile on the Gulf, was examined by Lieutenant Jefferson Vail and United States Assistant Engineer James Swift. Rather than examining the route from Muscle Shoals to the headwaters of the Tombigbee River, they surveyed a heavily traveled portage between the Hiwassee and Conasauga rivers, the former a tributary of the Tennessee and the latter of the Coosa River.[35]

This route had received much publicity in 1821 when the *Tennessee Patriot*, a fifty-foot long by six-foot wide keelboat, completed a journey from Kingston, Tennessee, to Montgomery, Alabama, with a cargo of flour and whiskey. It had

General Simon Bernard and the Army Engineers saw these island-studded rapids of Muscle Shoals, Tennessee River, in 1828.



dropped down the Tennessee from Kingston to the mouth of the Hiwassee, was poled up the Hiwassee and Ocoee rivers to a site about eleven miles overland from the Conasauga River, and was loaded on a great wagon drawn by oxen and portaged to the Conasauga where it continued its voyage down the Conasauga, Oostanaula, Coosa, and Alabama rivers to Montgomery. On May 10, 1822, a second boat arrived at Montgomery with a cargo of flour produced in Virginia on North Fork of Holston River above Kingsport, Tennessee. The boat had left Virginia on February 20, descended North Fork of Holston River, Holston and Tennessee rivers, then poled up the Hiwassee and Ocoee and over the portage to Alabama.[36]

Boatyards were constructed at each end of the portage, and in 1827 twelve thousand gallons of portable corn, the liquid variety, passed across the portage. Both Tennessee and Alabama chartered private companies which proposed to build a canal across the portage, but nothing resulted and the states appealed to the United States for aid. The result was the assignment of Lieutenant Vail and James Swift to the survey of the route.[37]

The two Engineers found the best site for a connecting canal was, indeed, at the portage, but such a project would require fifteen locks plus a reservoir to furnish water for the canal at a prohibitive cost of over a million dollars. These, unfortunately, were not the only difficulties, for to open the route to steamboats would require canals aggregating a hundred miles in length because of the low water levels of the little streams the canal was to join.[38]

Lieutenant Vail and Assistant Engineer Swift were also ordered to proceed to Muscle Shoals and survey that obstruction to determine how best it might be improved, but Swift was attacked by "bilious fever" on the way to the Shoals and the Lieutenant was unable to com-

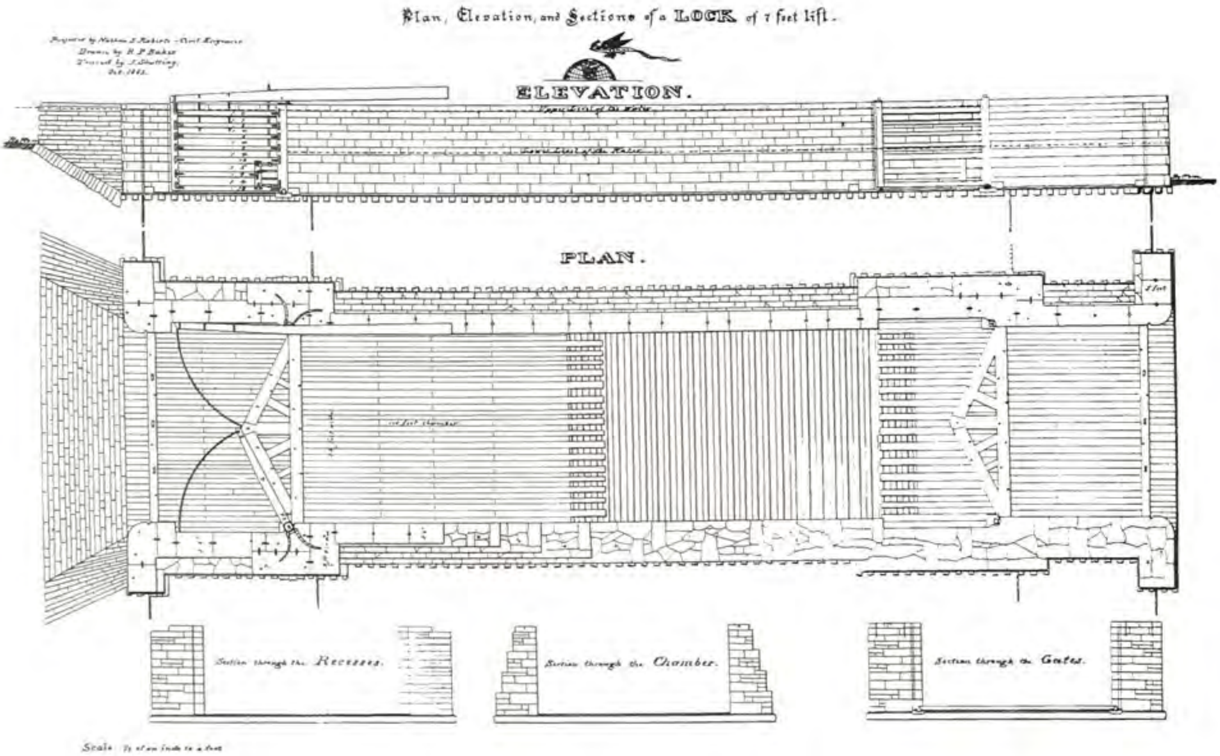
An 1828 map of Muscle Shoals, Tennessee River, drawn by General Simon Bernard, Corps of Engineers. The map was used for planning the Muscle Shoals Canal built by Alabama.

plete a survey because he, too, was afflicted by the fever.[39]

Of course, all of this feverish surveying by the Engineers was related to the "canal craze" which swept the nation after the completion of New York's successful Erie Canal in 1825. Pennsylvania, Ohio, Indiana, and other states followed New York's lead and an extensive system of canals sliced across those states within a few years. The Commonwealth of Kentucky joined in the "craze" by chartering the Louisville and Portland Canal Company to construct a canal around the Falls of the Ohio, which was completed and opened to navigation in 1830.[40]

Some of the planning for a few of the state canals was undertaken by the Board of Engineers for Internal Improvements, and in 1827 it was also involved in planning a canal around the Muscle Shoals of the Tennessee River when Congress appropriated $200 for a survey of the project. Since General Simon Bernard and Captain William Tell Poussin (both Frenchmen) of the Board of Engineers were in the Muscle Shoals area in 1827 surveying a route for a national road, they took time to scrutinize the Muscle Shoals obstructions, but they were unable to complete a formal survey because they came down with the same "bilious fever" which incapacitated Lieutenant Vail and James Swift.[41]

The Engineers saw enough, however, to make a favorable report on construction of a steamboat canal to conquer the Great Muscle Shoals, and Congress authorized the project, granting 400,000 acres of public lands to the State of Alabama, which were to be sold to finance construction. Alabama was bound to certain conditions by the grant: the improvement of the Shoals was to begin within two years and be completed within ten, the improvement was to begin at the lowest obstruction in the river and work upstream, the project was to be designed for the use of steamboats



An 1830 design plan for a Muscle Shoals Canal lock prepared by Nathan S. Roberts of Erie Canal fame. R. P. Baker of the Topographical Engineers was draftsman. This design called for a 118 by 32-foot lock chamber with 7 foot lift.

according to plans prepared by the Army Engineers, a connection was to be made which would open Elk River to regular navigation, and the canal was to remain free from all tolls unless authorized by act of Congress.[42]

Alabama accepted the proffered lands and the conditions upon which the grant depended, and the War Department dispatched Lieutenant Colonel James Kearney of the Board of Engineers for Internal Improvements to Muscle Shoals to prepare designs for the steamboat canal. Colonel Kearney commanded a "brigade" of assistants, seven young Army officers and two civilian assistant engineers, who were detailed to aid him in preparing plans, conducting surveys, and other duties connected with the Muscle Shoals Canal project. He left three assistants in Washington to handle the paper work, traveled with the remainder to Muscle Shoals during the spring of 1829, and spent most of a year collecting data, surveying, and preparing project designs.[43]

In January, 1830, the survey was completed and eight maps and profiles of the canal route were submitted to the Board of Engineers for approval, which was given on April 1, 1830. The Army Engineers proposed a canal thirty-five miles long to completely bypass the obstacles of Muscle Shoals at an estimated cost of $1,388,122.54.[44]

Construction was to be accomplished entirely with man and mule power, but the estimates of the Engineers were still quite detailed. It was estimated that sand and light-clay could be excavated and thrown into a cart or wheelbarrow for about six cents per cubic yard, while hard clay, requiring a man with a pickaxe besides a man with a shovel, would cost nine cents. About thirty cents per cubic yard was the estimated cost of blasting and removing limestone, and six cents per cubic yard was the estimate for moving earth forty yards in a wheelbarrow.[45]

After completion and approval of the Engineers' detailed plans, the State of

Clearing the canal line

Alabama organized a Board of Tennessee Canal Commissioners to contract for construction and to employ resident engineers. Contractors came from as far away as Ohio, New York, and Pennsylvania, where they had been constructing other canals, to bid on the job. Lieutenant Jacob A. Dumeste, United States Army, who had accompanied Colonel Kearney on the survey of the Shoals and who surveyed the "Suck" for the State of Tennessee, was employed to inaugurate construction, and he did so on December 1, 1830.[46]

Muscle Shoals was actually a series of shoals, stretching over thirty miles of the mainstream of the Tennessee from Decatur down to Florence, Alabama. The names of the various reefs within varied from time to time, but became commonly known, proceeding downstream, as the Elk River Shoals, Big Muscle Shoals, and Little Muscle Shoals. Colbert and Bee-Tree Shoals in the Tennessee below Florence occasionally were included in Muscle Shoals, but it eventually became customary to treat them as a separate set of obstructions.[47]

It was the intent of Congress and the Engineers that the improvement project should be initiated by blasting a channel through Colbert Shoals, then constructing the canal at Little Muscle Shoals and working up river, but Alabama's Board of Tennessee Canal Commissioners departed from the plan. The Board secured permission from Congress to begin canal construction at Big Muscle Shoals, the most difficult obstacle to navigation in the series of shoals, before constructing the canal sections which would bypass Elk River Shoals above and Little Muscle Shoals below.[48]

Plans for the Big Muscle Shoals Canal section were prepared by Nathan S. Roberts, an engineer with experience on canal construction in Pennsylvania and on the Erie Canal in New York. He had designed the famed high locks at the western end of the Erie Canal. Roberts prepared his plans in beautiful water colors, with detailed drawings of the stone masonry locks—sixteen locks with an aggregate lift of 86 feet were planned in the canal on the north side of Big Muscle Shoals.[49]

Alabama's plans went to Washington for review by the Board of Engineers for Internal Improvements, and Lieutenant Colonel Kearney, Captain William Tell Poussin, and Colonel J. J. Abert reported their opinions of the plans of the Tennessee Canal Commissioners in March of 1831 and they were highly uncomplimentary.[50]

The officers castigated the Canal Commissioners for departing from the Army Engineers' plans for the project by improving the middle section of the Shoals first; they pointed out that "a boat cannot go further for want of the improvements to pass over the impediments abcve and below." Nor did the Canal Commissioners' plans meet the requirement of Congress that the mouth of the Elk River be opened to navigation, because the canal would not reach Elk River Shoals at all. In addition, the Engineers warned the canal would be in serious danger of washing out because streams were to be permitted to flow into it.[51]

The admonitions of the Engineers fell, unhappily, on deaf ears, and the Canal Commissioners were permitted to follow their own plans, rather than those prepared by the Army Engineers. Contracts were let for the excavation of the canal, and more than 600 men (mostly slaves hired from their masters) were soon wielding the pick and shovel and lashing the mules, while other more skillful workmen built the masonry locks. The cost of lock construction was reported as quite low, running between $5.25 and $6.50 per perch of 25 cubic feet of masonry and averaging, including every expense, about $1,500 per foot of lock lift.[52]

Below Florence at Colbert Shoals the rocky reefs were blasted away in an effort to create open channel, or "sluice" navigation, but the contractors found the rock extremely flinty and hard. The Canal Commissioners petitioned Congress for an appropriation of $210,000 to finance the construction of a three-mile lateral canal around Colbert Shoals, explaining a canal would be as cheap and certainly would be more beneficial to navigation than merely excavating the channel. Congress heartily approved of "canalling

instead of sluicing" at Colbert Shoals. but appropriated no funds for the project, and the Canal Commissioners finally suspended work at Colbert Shoals.[53]

Colonel Kearney returned to Muscle Shoals to inspect construction progress in early 1836. He found the flinty river bottom at Colbert Shoals was indeed very resistant to excavation and that blasting had been only partially beneficial, because the removal of rock below the edge of various rock reefs had created over-falls which hindered ascending traffic; that is, blasting rock out of the channel had merely changed the location of navigational difficulties.[54]

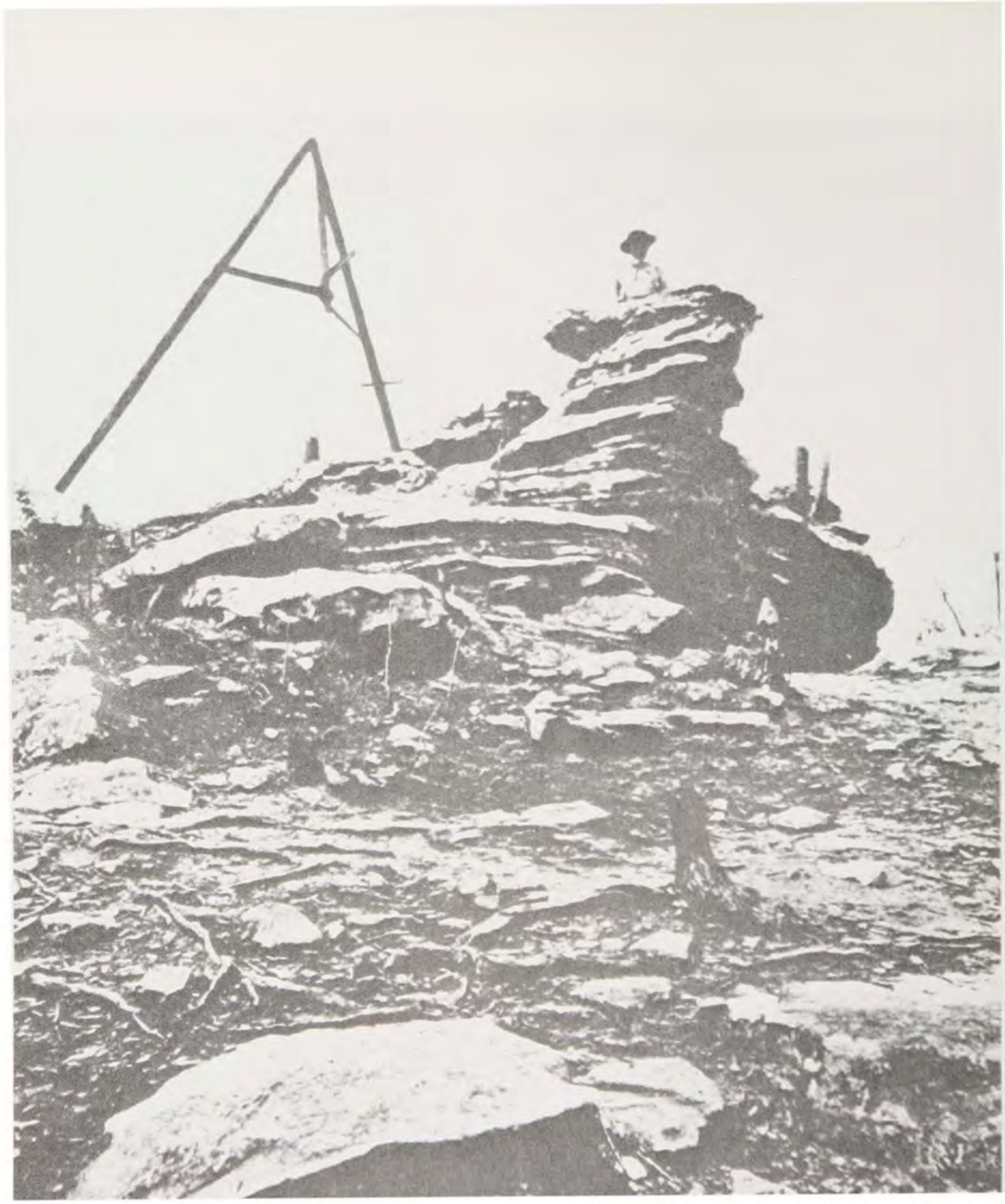
He agreed with the Canal Commissioners—rock excavation at Colbert Shoals merely squandered money and a canal would be infinitely preferable. On the other hand, Kearney found the completed portion of the canal at Muscle Shoals was well constructed, with the sixteen (fourteen lift and two guard) locks and three towing-path bridges nearly ready for use.[55]

The entire project was in serious financial difficulty, however, because the proceeds from land sales were proving inadequate. In 1836 Congress authorized a reduction in the price of the unsold public lands to stimulate lagging sales, and also provided that Alabama might charge tolls to fund the operation and maintenance of the canal, but neither provision produced the necessary funds.[56]

Thomas Williams, chief engineer at the project, predicted the canal would be open to navigation in January of 1837. Construction was delayed, however, by high waters and by serious disease among the workers, and the canal was not watered until July of 1837.[57]

The canal engineer described the completed canal section as about twelve miles in length, of which a third was

An old canal lock at Muscle Shoals, Tennessee River.



Early Engineer surveyor using tripod for triangulation and mapping.

embanked in the river bed behind protective walling, with a minimum depth of six feet and width of sixty feet. He stated that each lock had dimensions of 120 by 32 feet, quite adequate for the traffic, but he lamented that no culverts had been installed to pass tributary streams under the canal, for the streams were entering it and leaving deposits of gravel and silt.[58]

Williams candidly admitted that the canal was of little benefit to river navigation. "A great quantity of cotton has passed through Muscle Shoals Canal," he said, "but for some weeks past the unusual lowness of the water has completely suspended the navigation; not that there is any difficulty in passing through the canal itself, but the water on the shoals above and below it . . . is so

shallow as to prevent boats from getting into it."[59]

The Canal Commissioners admitted the operation of the canal presented problems, but quickly added that it "overcame the greatest obstructions, and to render it at all seasons useful it ought to be extended. . . ." Indeed, they had contracted for the construction of the Elk River Shoals Canal section, but had been forced to annul the contract when it became apparent that funds were insufficient.[60]

The Commissioners pleaded for further appropriations, asking Congress "whether this great national improvement is to be arrested in its present state? Shall a work . be left unfinished, a monument alike of the folly and parsimony of the undertakers?" The Commissioners claimed the completed work alone constituted the longest steamboat canal ever constructed in the United States, pointed out the construction had been accomplished at less than the original estimates, and made repeated requests for funds to complete the project, but all in vain.[61]

The national depression which began in 1837 and the opposition of the administration of President Martin Van Buren to internal improvements at Federal expense brought any hopes of completing the project to an end, leaving it a "monument of folly" indeed. No further appropriations for the important work at Muscle Shoals were forthcoming from the national government until after the Civil War. Alabama's Muscle Shoals Canal was abandoned to the elements shortly after it opened, not to be reopened until 1890 after a complete reconstruction by the Corps of Engineers. Without doubt, the failure of the State of Alabama at Muscle Shoals Canal was a severe blow to commerce and industry in the Tennessee Valley, alleviated only by the advent of the railroad.

The first railroad west of the Appalachian Mountains and one of the earliest built in the United States was under construction at Muscle Shoals at the same time the canal was being excavated. Alabama incorporated a railroad company to construct a two-mile line between Tuscumbia and the Tennessee River in 1830, and in 1832 the Tuscumbia, Courtland, and Decatur Railroad Company was authorized to build a railway around Muscle Shoals. The company began operations on the little forty-mile line in 1834 with cars pulled from Decatur to Tuscumbia by horses, replaced in 1835 by a steam locomotive; however, the limited capacity of the road and the costs of transferring cargo from boats above the Shoals to the railroad and back to boats below were serious handicaps to its operations. Completion of the little rail line was, nevertheless, an omen of the future and a baneful portent for the steamboat lines.[62]

Although the railroad did provide an alternative route for commerce around Muscle Shoals, its construction was not the reason for the failure of the canal. The principal reason was the failure of the Canal Commissioners to comply with the plans prepared by the Army Engineers; plans which provided for a canal around the entire series of shoals and for aqueducts to cross the canal over the streams along the route. Alabama's canal as constructed could only be useful to river traffic when the Elk River Shoals and Little Muscle Shoals above and below were submerged, and at that river stage the Big Muscle Shoals were also covered to a navigable depth. Many shippers then utilized the main channel of the river, thereby avoiding the payment of canal tolls and the delay of locking through the canal.

The Canal Commission admitted this was the problem, but they maintained that as much of the canal as possible had been constructed with the available funds in an economical fashion and thrust the blame on Congress for failing to provide the financial support necessary to complete the project. Perhaps it might be best to lay the responsibility for the failure of the Muscle Shoals Canal on the depression of 1837 and the political principles held by many Americans during that era—Americans who questioned the constitutionality of undertaking internal improvements at Federal expense.

The Army Engineers' surveys and plans for the Southern Route prepared

during this first flurry of national civil works activities were filed away, and, for the most part, forgotten, though the dream of a Southern Route did not die. On the other hand, the Engineers made a promising beginning in the improvement of the western inland waterways by open channel methods during this same era, and both the Cumberland and Tennessee rivers were improved by these methods before the Civil War.

CHAPTER IV

THE ENGINEERS TACKLE THE TWIN RIVERS

From the enactment of the General Survey Act and the first Rivers and Harbors Act in 1824 until the Civil War, sporadic efforts at improving the navigation of the western rivers were executed by the Corps of Engineers and the Topographical Engineers; efforts which could only be piecemeal because the political question which troubled the nation, the dispute concerning the relative powers of the national government and state governments, precluded any systematic approach to and continuous program of waterways improvement.

The channel of the cantankerous Cumberland was improved by the Army Engineers from 1832 to 1840, and the tortuous Tennessee received similar attentions a few years before the onset of the civil conflagration. But the Engineers' improvements on both rivers were interrupted by factious quarreling over the constitutionality of the prosecution of civil works with Federal funds.

The serpentine channel of the green-bordered Cumberland was first improved by the Engineers during the administration of a President who had navigated its course on many occasions as traveler, merchant, and general at the head of an army. Andrew Jackson of the Hermitage understood the navigational problems of the capricious Cumberland perhaps better than any other President.

President Jackson gained a reputation as an opponent to internal improvements as national policy because he vetoed several internal improvement bills, but almost seven million dollars were appropriated for the improvement of rivers and harbors during his administration. Actually, Jackson's vetoes of rivers and harbors bills were selective, in keeping with his pragmatic approach to government, and he approved in general of the improvement of waterways below ports of entry, although this principle resulted in a proliferation of ports of entry by acts of Congress in order that navigation might be improved.[1]

In 1825, as steamboats began to throng the Cumberland, the State of Tennessee petitioned Congress for a survey of the river, the hazardous Harpeth Shoals in particular, by the Army Engineers and for federal aid in improving the river's channel. The Cumberland, "which is the principal source of egress for the produce of the state," said the Nashville *Whig*, "is superior to almost any other stream of the same magnitude in the union, for safe and convenient navigation; and by the expenditure of a comparatively small sum of money, in cleaning out the channel at some few points, might be rendered at all seasons navigable."[2]

After Jackson's election to the presidency in 1828, Tennessee's legislature reminded the President of the value of the Cumberland, particularly the supplies sent from the Cumberland Valley to his army at New Orleans in 1814-15. Perhaps this reminder had some influence, for the improvement of the Cumberland by the Army Engineers began during Jackson's first presidential term.[3]

In 1832, Captain Henry M. Shreve, Superintendent of Western River Improvements for the Engineer Department, built a dam in the Ohio River at the mouth of the Cumberland. The waters of the Ohio are divided by an island at the mouth of the Cumberland, forming two channels, or "chutes." Captain Shreve built a dam across the right chute to

1832 map of Harpeth Island Shoals by Delafield and Shreve.

force the current of the Ohio into the "Kentucky chute"; thus, he diverted river traffic past Smithland, Kentucky, at the mouth of the Cumberland. The purpose of the dam was to bypass a shoal in the Ohio on the Illinois side of the island and to scour away a sand bar at the entrance to the Cumberland by increasing the volume of water flowing through the "Kentucky chute." The citizens of Smithland at first objected to Shreve's dam, but were soon satisfied when they discovered that many boats which previously had difficulty in landing at Smithland were now approaching with ease.[4]

When Congress enacted the first appropriation bill for the improvement of the Cumberland River in 1832, there were no plans in existence for a Cumberland River project, and Congress simply designated $30,000 "to be expended under the direction of the War Department" on the improvement of the Cumberland. Since Captain Shreve was then constructing the dam at Smithland, he and Captain Richard Delafield, Corps of Engineers, were ordered to examine the river from its mouth to Nashville and to devise a plan for its improvement.[5]

The Engineer officer who accompanied Shreve on the trip up to Nashville in September of 1832, Captain Delafield, served in the Corps of Engineers a total of forty-eight years, 1818-1866, was twice Superintendent of the United States Military Academy, and was breveted Major General for his services as Chief of Engineers from 1864 to 1866. It was Delafield who designed the castle insignia which have become the symbol of the Corps of Engineers.[6]

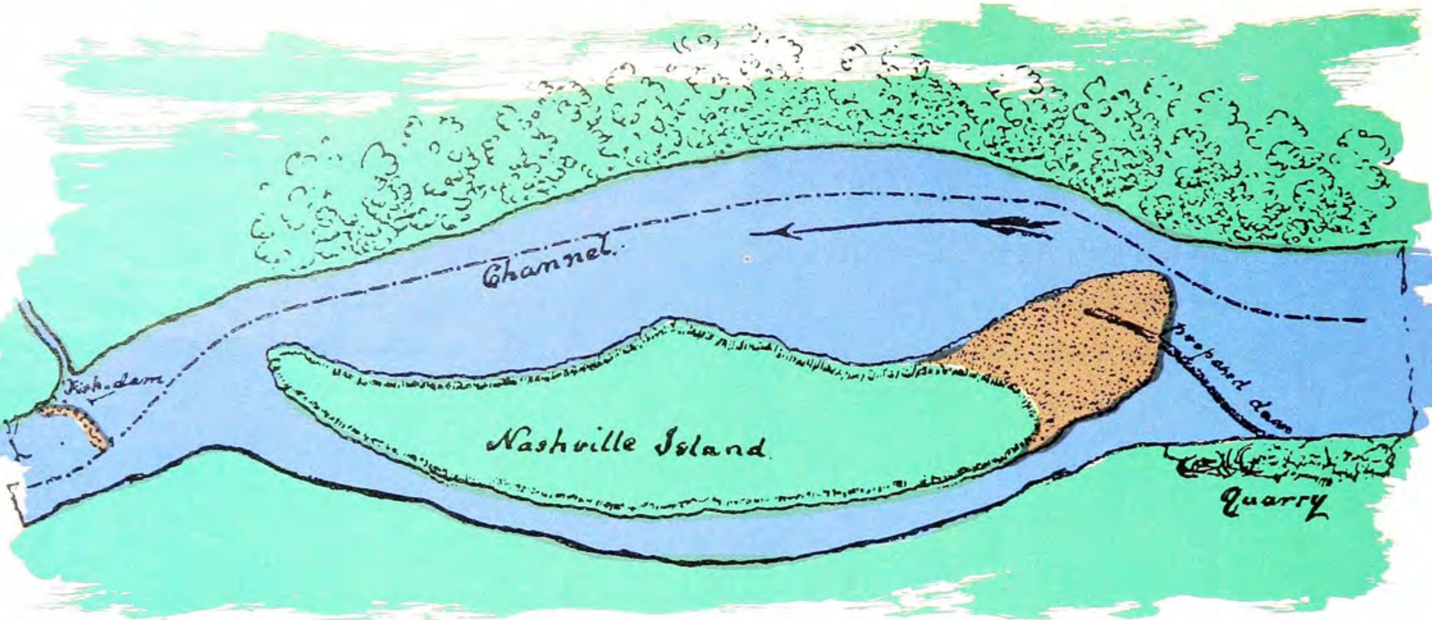
Shreve and Delafield made their examination of the Cumberland from the deck of a steamboat while running up to Nashville and back, and submitted their joint report on a project for the improvement of the Cumberland, accompanied by sixteen sketches of the worst obstacles to navigation and the necessary improvements, on October 3, 1832. They found the difficulties encountered in navigating the Lower Cumberland were of four varieties: a dense growth of tangled timbers overhanging the channel, many snags and logs embedded in the river bottom, isolated rocks and reefs, and extremely shallow shoal waters. They recommended the simple remedies of clearing away the timber, removing snags and logs, blasting away rocks, and constructing longitudinal wing dams at shoals to confine the channel and increase its depth.[7]

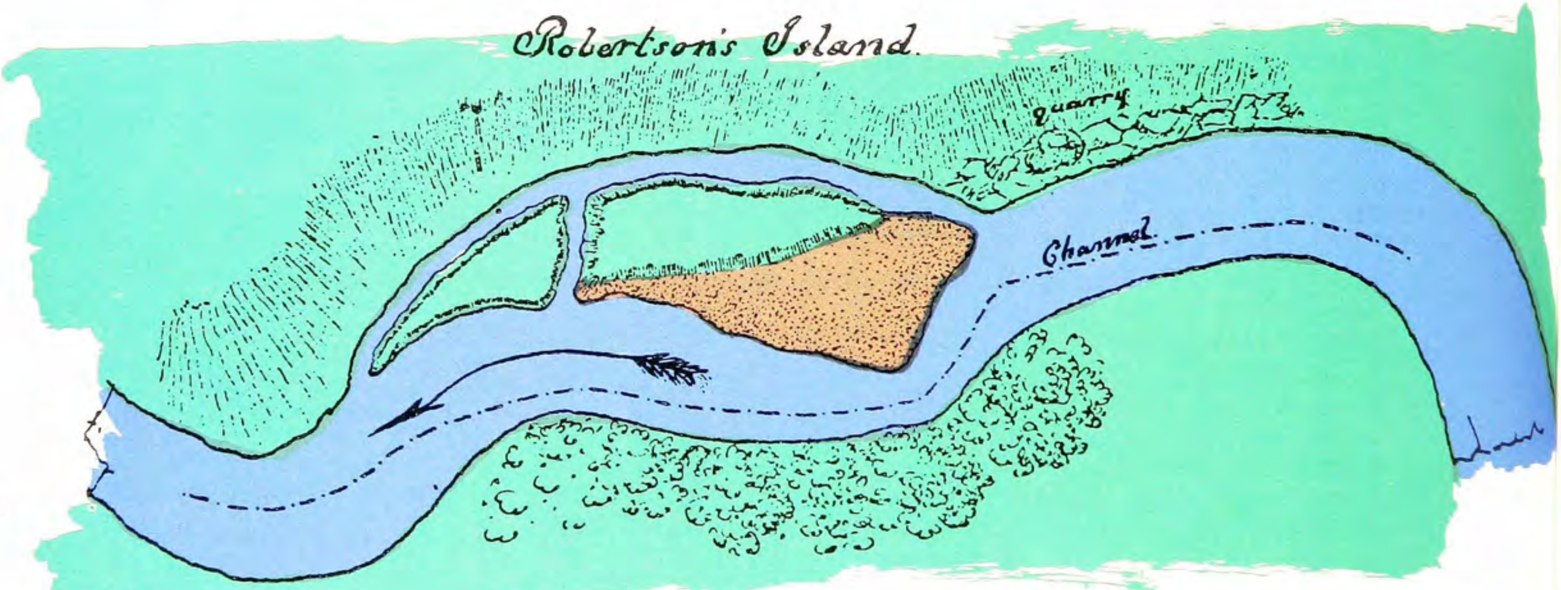
Captain Shreve informed the Engineer Department it was absolutely impossible for him to supervise the improvement of the Cumberland, for his other duties were much too heavy. Hence, he and Captain Delafield chose William McKnight for the job, designating him "Superintendent of the Improvement of the Cumberland River." Captain McKnight (apparently deriving his rank as captain of a steamboat) was required to make penal bond to guarantee the faithful performance of his duties, because he was charged with the disbursement of funds as well as the immediate direction of the project. Captain Shreve retained general supervision of operations and was directed to make inspections from time to time, but he merely delivered a copy of the report he and Captain Delafield had prepared to McKnight and left the improvement to McKnight's initiative.[8]

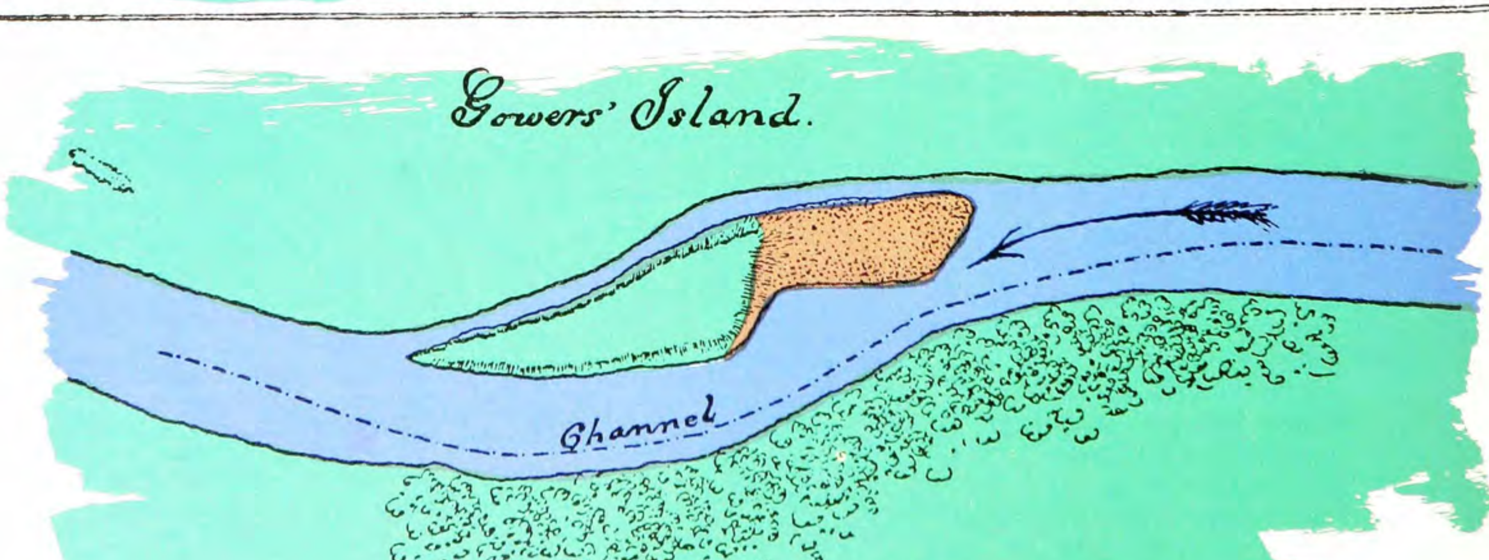
A Nashville newspaper gleefully proclaimed that the improvement of the Cumberland had at last begun: "It will be gratifying to the numerous friends of Capt. S[hreve], to find that his zeal and ability are duly appreciated at Washington; and the fact that Capt. M'Knight is successfully engaged in the improvement of Cumberland River will be learned with pleasure by a large portion of our readers."[9]

From October 16 to December 7, 1832, McKnight rapidly initiated the improvement of the river, purchasing tools from his own money (for which he was later reimbursed) to arm the crew of fifty laborers he dispatched to clear timber from the banks of the river and to remove logs from sand bars between Nashville and Harpeth Island. High water closed the work in December, and McKnight traveled to Louisville to confer with Captain Shreve about the next season's labors.[10]

Captain Shreve transferred the steamboat *Virginia* to the Cumberland River







1832 maps of shoals and islands on Cumberland River by Shreve and Delafield.

Improvement Project in 1833, at McKnight's request, to tow the scows for moving stone and the machine boats for pulling snags which McKnight had under construction on the Cumberland. During the 1833 and 1834 working seasons, McKnight's workmen cleared the banks of the Cumberland of trees and driftwood from Nashville down to Camp Rowdy (near the present site of Barkley Dam), raised a number of wrecked boats from the channel, blasted away obstructive rocks, and constructed wing dams at the shoals.[11]

McKnight's original plan of operation was to proceed from Nashville down river to Smithland with the improvements, but numerous complaints from rivermen induced him to deviate from his plan and dispatch crews of workmen to clear obstructions from Devil's Chute and Line Island channels (near the Tennessee-Kentucky state line). Nor did the project proceed entirely without mishap, for the steamboat *Virginia* sank at Palmyra Island Chute in 1833 and was out of service until refloated and repaired, and a cholera epidemic interrupted operations in 1835 because laborers employed on the project dispersed for fear of sudden death.[12]

After inauguration of the improvement of the Lower Cumberland, the citizens of the Upper Cumberland Valley became exceedingly anxious for an extension of the project to the river above Nashville, and in 1834 Congress responded by directing the Secretary of War "to send an engineer to extend the navigation of the Cumberland river from Nashville up to the falls, or to the highest point on said river susceptible of being made navigable for steamboats [steamboats had reached Creelsboro and Point Isabel, Kentucky, on present Lake Cumberland in 1833]."[13]

The Chief of Topographical Engineers ordered Howard Stansbury, United States Civil Engineer, to make the survey as directed by Congress. Stansbury had been employed by the Engineer Department for a decade prior to 1834 and was engaged in surveys of rivers and canals in Indiana when ordered to the Upper Cumberland. He was later commissioned in the Topographical Engineers and par-

General Richard Delafield. He surveyed the Lower Cumberland River in 1832.

ticipated in many early expeditions to the Far West. In 1849-50, as example, he explored the Great Salt Lake region in Utah, guided by the renowned "Mountain Man" Jim Bridger, and blazed a trail which was followed by the Overland Stage, the Pony Express, and the Union Pacific Railroad.[14]

Stansbury arrived at Nashville on August 6, 1834, and began his survey of the Upper Cumberland two days later. He found the Upper Cumberland quite an impressive river, describing it as a "noble, but wild and fluctuating stream." "The importance of opening any course of navigation," he generalized, "must be estimated chiefly from a consideration of the natural products which will thereby find an outlet to market, the comparative difficulty of other modes of access to it, and the present or prospective amount of population interested in its use. In either of these points of view, the importance and necessity of the contemplated improvement of the navigation of the Cumberland River must be manifest."[15]

The Upper Cumberland Basin abounded with forest and farm products, but Stansbury was profoundly impressed by the abundant mineral resources he found in commercial quantities: coal,

Nashville as Shreve saw it in 1832

iron, salt, alum, nitre, cooperas, gypsum, lead, and glauber salts. Coal was the most important of these—an "inexhaustible supply of bituminous coal" of excellent quality, proclaimed Stansbury—and it was being mined a few miles above Point Isabel (Burnside) in Kentucky.[16]

The Engineer predicted the mouth of the Laurel River, tributary of the Cumberland near Corbin, Kentucky, would become the depot for coal shipment and, hence, should be considered the head of navigation on the Cumberland. He found about twenty-five coal mines, employing 250-300 men, in operation near the mouth of the Laurel and a substantial trade was developing. Cumberland coal was loaded into "arks" and floated down to Nashville and other points on a spring rise, or "tide." In 1833, forty-one boats, each with a capacity of about 2,500 bushels of coal, had descended the river to market, and while Stansbury was surveying the river in 1834 there were about a hundred building for the season. Each "ark" load of coal produced a profit of approximately $265, and Stansbury believed this trade alone would justify improvement of navigation up to the mouth of the Laurel River.[17]

His final report on the Upper Cumberland River divided its course into four sections for convenience, with slightly differing improvements proposed for each section.[18]

The uppermost section, Cumberland Falls to the mouth of the Laurel, was closed to navigation at low water stages by great boulders, while at higher stages, said Stansbury, the waters "foam and rage with inconceivable violence in their efforts to force a way through them [stones], presenting a scene at once of terror and of the wildest magnificence." He believed the expense of removing

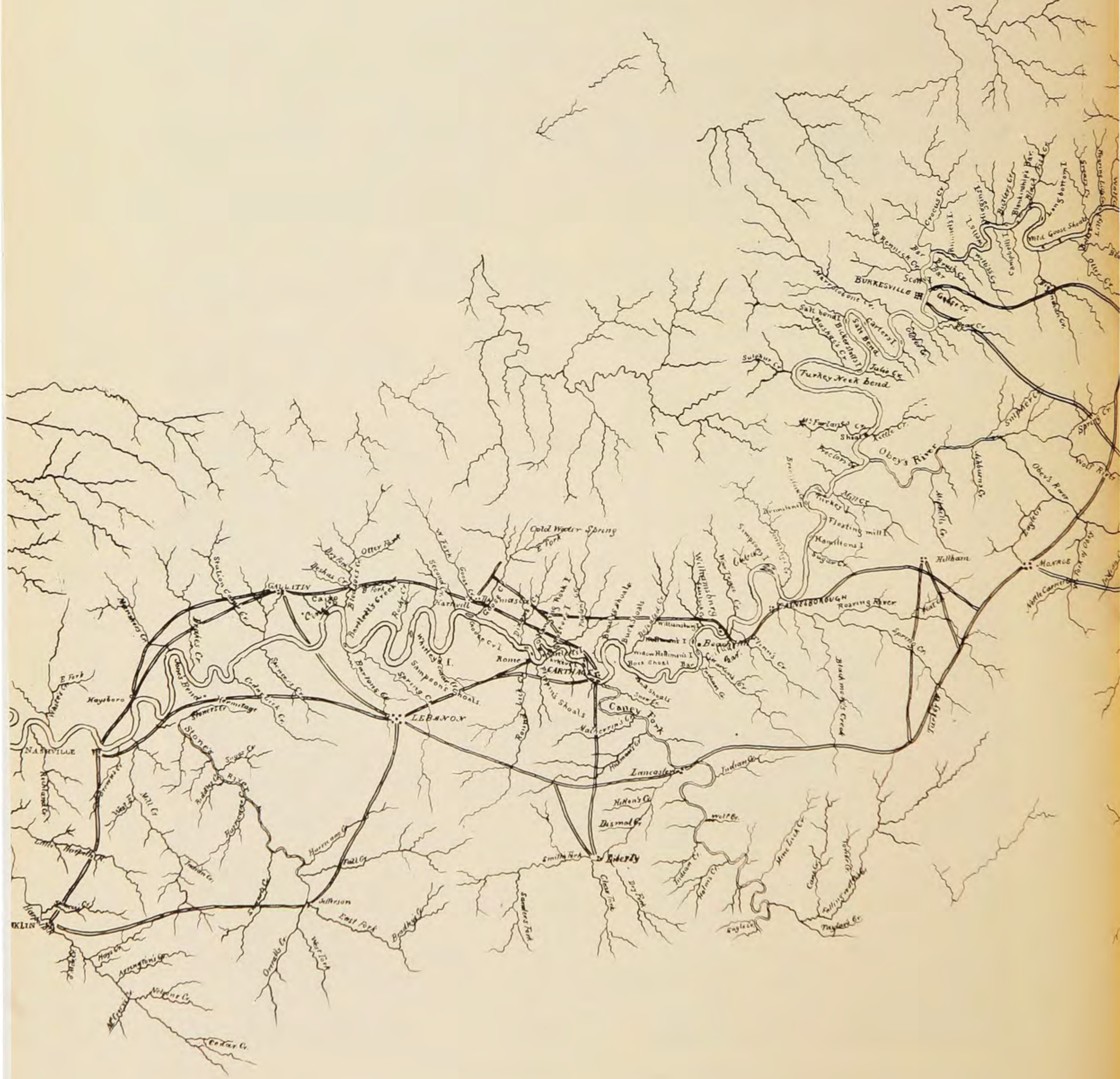
Cumberland Falls as seen by Howard Stansbury in 1834. Notice face-like profile rock formation on right.

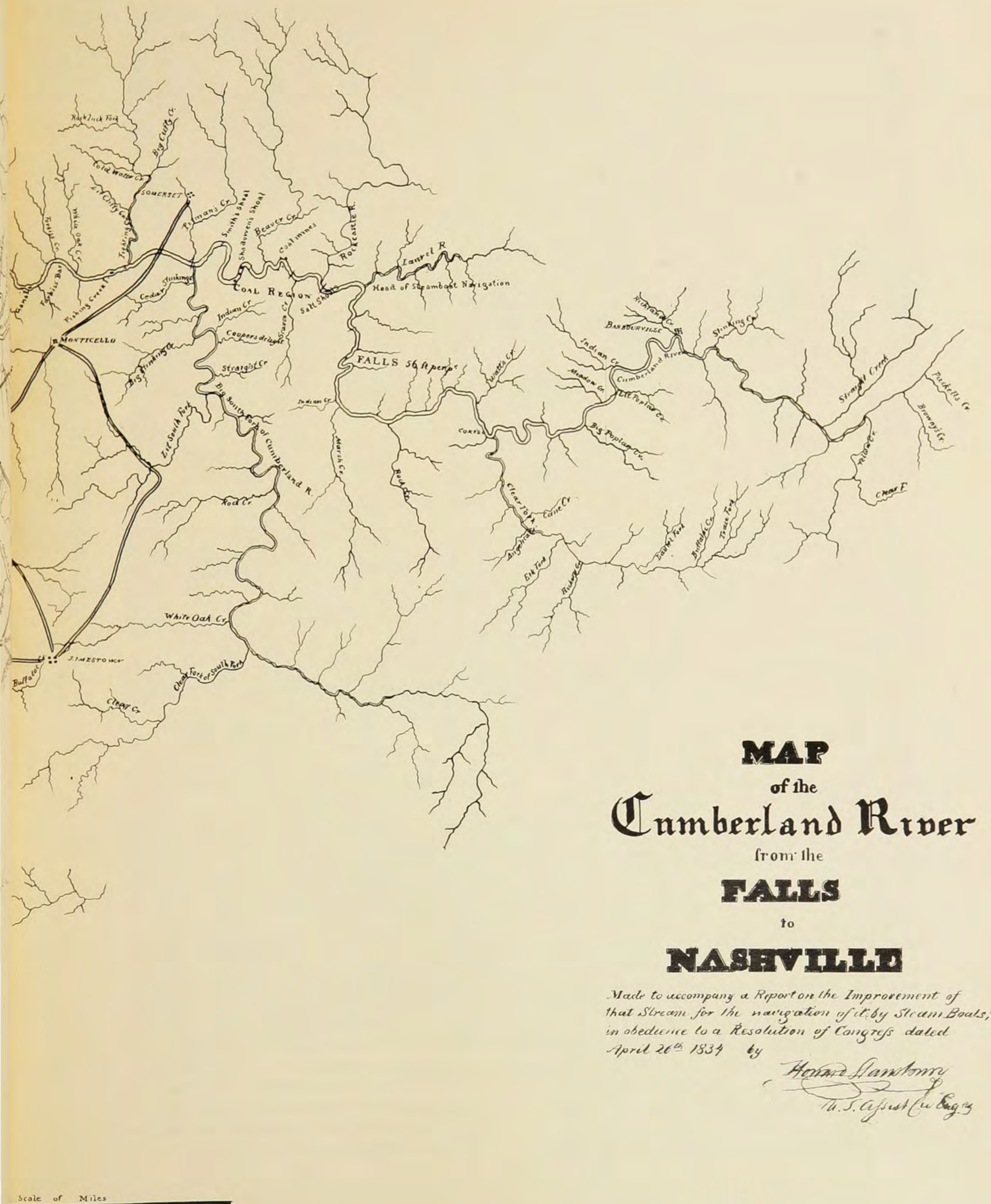
these huge boulders would be much greater than the benefits to be gained, but added that improvement might be necessary in the future because the great reserves of coal and iron in combination with abundant water power at Cumberland Falls might soon attract "manufacturing enterprise."[19]

The second section, from the mouth of the Laurel to the mouth of the Big South Fork, was obstructed principally by Smith's Shoals, where many coal barges were lost annually and where the river fell fifty-four feet in less than six miles, a mighty obstacle indeed. Stansbury listed five ways Smith's Shoals might be improved: lateral canals of the sort under construction at Muscle Shoals on the Tennessee, a slackwater system of locks and dams, wall dams parallel with the current on both sides of the channel, sluice dams across the river with openings for the coal boats to surge through during high waters, and wing dams. He rejected the first four because of their cost and recommended the adoption of a project to build wing dams "perpendicular" to the current, with an inclination down stream, to gather the waters, force them into a regular channel, and thus increase the navigable depth over Smith's Shoals.[20]

For the two lower sections, between the mouth of the Big South Fork and Nashville, Stansbury recommended only snag, timber, and rock removal, plus the construction of a few wing dams at shoals. He estimated that the total cost of the improvements he proposed above Nashville would be only $45,192.10, which would be well justified by the benefits which would accrue from opening the Upper Cumberland Basin to navigation. Congress accepted Stansbury's recommendations in 1837 and made an appropriation for the improvement of the Cumberland above Nashville.[21]

East Tennessee coal mine about 1900.


BURKESVILLE
Turkey Neck Bend
Salt Bend
Carters I
Sulphur Cr
Wild Goose Shoals
Obey's River
Floating mill
Hamiltons I
Hillham
Roaring River
Spring Cr
Cold Water Spring
Rome
CARTHAGE
Caney Fork
Lancaster
LEBANON
Haysboro
Hermitage
NASHVILLE
Mill Cr
Jefferson
East Fork
Liberty
Dismal Cr
Indian Cr
Cedar Cr


MAP
of the
Cumberland River
from the
FALLS
to
NASHVILLE
Made to accompany a Report on the Improvement of that Stream for the navigation of it by Steam Boats; in obedience to a Resolution of Congress dated April 26th 1834 by
U.S. Assist Civ Engr
Scale of Miles
SOMERSET
MONTICELLO
JAMESTOWN
BARBOURVILLE
COAL REGION
Head of Steamboat Navigation
FALLS 56 ft perpr
Laurel R.
Rockcastle R.
Big Cutty Cr.
Cold Water Cr.
Pitmans Cr.
Smiths Shoal
Shadowens Shoal
Beaver Cr.
Coal mines
Salt Shoal
Indian Cr.
Coopers delight
Straight Cr.
Big South Fork of Cumberland R.
Ltl South Fork
Big Sinking Cr.
Cedar Sinking Cr.
Fishing Creek
Rock Cr.
White Oak Cr.
Clear Fork of South Fork
Clear Cr.
Marsh Cr.
Watts Cr.
Clear Fork
Cane Cr.
Elk Fork
Richland Cr.
Stinking Cr.
Meadow Cr.
Ltl Poplar Cr.
Big Poplar Cr.
Cumberland River
Straight Creek
Puckets Cr.
Browns Cr.
Clear F.

Henry M. Shreve directing snagging operations.

by Lloyd Hawthorne
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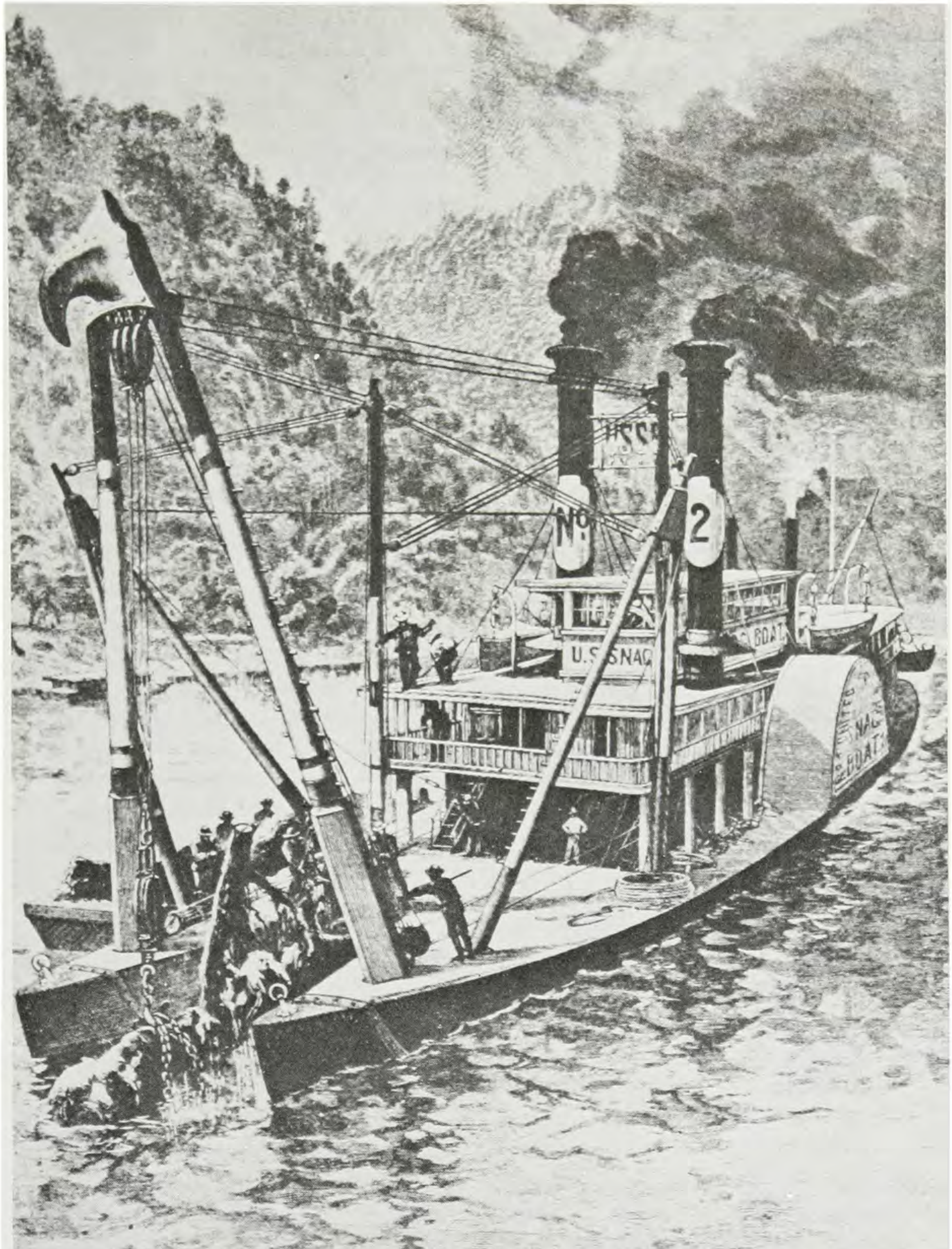
R. W. Norton Art Gallery
Shreveport, La.

General supervision of the Cumberland River Project was assumed by Lieutenant Alexander H. Bowman in the same year Stansbury made his survey, while Captain McKnight continued in local charge. Lieutenant Bowman was just nine years out of the Military Academy when he was assigned supervision of operations on the Cumberland. In later life, he became an authority on the use of concrete in construction and succeeded Richard Delafield as Superintendent of West Point in 1861.[22]

Bowman made his first inspection tour of the Cumberland in 1834 and suggested certain additional improvements, such as construction of wing dams at Nashville Island, Sycamore Creek, Palmyra Island, Dover Island, and Ingram's Shoals on the lower river, if the improvement were to be pursued as far as would be advantageous. When the improvements he listed were completed, he claimed, there would be "no further means of benefiting the navigation of the Cumberland river from Nashville to its mouth."[23]

Young Lieutenant Bowman's duties were truly overwhelming, for he was charged not only with general supervision of operations on the Cumberland, but also with construction of a military road from Memphis to St. Francis, Arkansas, and inspection of river improvements on the Mississippi and Ohio. His responsibilities were so far-flung he was able to make only an annual inspection of the Cumberland River Project and in



Corps of Engineers' Snagboat No. 2 built about 1853.

one year was unable to accomplish even that. As a result, the improvement of the Cumberland was left very much to the discretion and intiative of Captain William McKnight, whose duties were greatly augmented by the extension of the Cumberland River Project to the section above Nashville in 1837 [24]

Captain McKnight dispatched a gang of workmen up the river from Nashville and another down from Carthage to clear timber from the banks and logs from the channel. He employed Captain W. H. Horn of Nashville to build boats, purchase provisions, and employ laborers at the mouth of the Laurel River, and also acquired the services of one of Captain Shreve's steam-powered snag-boats, the *Laurel*, which had previously been engaged in removing the great log raft which jammed the Red River of Louisiana, for the Upper Cumberland Project. The *Laurel* left Louisville, Kentucky, on May 14, 1838, with a load of stores and machinery for the snag-boats McKnight was building at the mouth of the Rockcastle River, and arrived at Smith's Shoals on the Upper Cumberland on May 30. McKnight then put it to work snagging around Carthage before laying it up for repairs.[25]

In 1838 Captain McKnight had working parties laboring on both the Upper and Lower Cumberland; 130 men were building dams, blasting rock, and clearing the river below Nashville, while another crew descended the river from Smith's Shoals to Nashville, cutting 9,784 trees, belting another 1,177, sawing up 1,413 logs, removing 37 snags, and blasting dangerous rocks.[26]

In that same year, in a general reorganization of the responsibilities of the Army Engineers, the Topographical Engineers were assigned the direction of the civil works program, previously the duty of the Corps of Engineers. William McKnight, on the Cumberland, was

Flatboat landing at Chattanooga.

notified in early 1839 that Colonel Stephen H. Long, Topographical Engineers, had assumed direction of the Cumberland River Project and would shortly make an inspection of its progress. The famous Colonel was, however, delayed by other important work—surveying the route of the Western and Atlantic Railroad for the State of Georgia. (During these surveys for Georgia, Colonel Long had founded "Terminus," which became Marthasville and eventually the city of Atlanta.)[27]

Captain McKnight was very anxious, understandably so, about the effect of this change of command upon the Cumberland River Project, and he offered to meet Colonel Long at Louisville, Nashville, or at Monticello, Kentucky, to accompany him during the inspection, but, when the Colonel proceeded to Carthage to make the inspection without McKnight, the Superintendent tendered his immediate resignation. After the Colonel completed his investigation, and was quite complimentary to Captain McKnight in his report, the Superintendent regretted his hasty resignation, but it was too late.[28]

Colonel Long reported a vast number of logs, snags, and trees had been removed from the Cumberland and the work as a whole had been accomplished "effectually" with immense benefit to navigation. McKnight had, said Long, carried out his duties, with "due skill and judgement."[29]

The wing dams built on the Cumberland, over 6,075 linear yards of them, were well constructed, varying in height from four to eight feet and in width from eight to sixteen feet. The body of each dam consisted of irregular stones, the largest applied to the crest and sides of the structure, which had become impervious to water because weeds, leaves, and brush had filled the spaces between the stones.[30]

Colonel Long's report concluded an estimated $26,875 would complete the plans for "sluice" navigation on the Lower Cumberland, but only "temporary and occasional accommodation" would result. Hence, Colonel Long recommended abandonment of the open-channel projects planned by Shreve, Delafield, and Stansbury in favor of the construction of a system of locks and dams: a slackwater, canalization project. The Colonel suggested: "A dam about five feet high should be constructed at or near the foot of every rapid and a lock of about the same lift should be connected with it. . . . The walls and gates of the lock, as also any guard walls, pierheads, or moles connected with the locks, should be carried about eight feet higher than the dam, in order to admit passage of boats . . . till the river . . . shall have risen nearly to the top of these parts of the work, when . . . boats may pass and repass across the crest of the dam."[31]

Colonel Long was convinced the benefits of a slackwater project on the Cumberland would greatly exceed its costs; indeed, he said, "the increasing wealth and importance of the country drained by the fine river will soon justify any efforts that may be made to render it a channel of uninterrupted navigation, not only from its mouth to Nashville, but even to the extensive and inexhaustible coal-fields that occur three to four hundred miles higher up the river."[32]

Colonel J. J. Abert, Chief of Topographical Engineers, fully concurred with Long's request for a survey to plan a slackwater navigation project for the Cumberland and asked Congress to appropriate $5,000 for that purpose, but the funds for the survey were not forthcoming, nor were any to complete the "sluice" navigation project then under construction.[33]

Captain William McKnight settled his accounts with the United States, closing operations, and the Engineer fleet on the Cumberland, snag-boats, stone scows, and survey boats, was tied up at Dover, Tennessee, under the care of T. M. Hale, who maintained it for two years. In 1841 the fleet was sold at public auction, but the receipts were not sufficient to pay Hale for his troubles.[34]

Congress had appropriated $155,000 for the improvement of the Cumberland between 1832 and 1838, $100,000 for the river below Nashville and $55,000 also applicable to the river above. As Colonel Long reported in 1839, the work had been of immense benefit to navigation on the Cumberland, Ohio and Missis-

sippi. Steamboats no longer had to transfer cargo and passengers to smaller boats at Smithland, and, instead, steamed all the way to Nashville at will. But the "sluice" project was never completed and Congress did not authorize further improvement of the Cumberland until 1871.[35]

Reasons for the abrupt end to the improvement of the Cumberland in 1839, and that of most other river improvement projects, were the financial squeeze of the national depression of 1837 that bankrupted many state governments, and the opposition of the Van Buren administration to the Federal civil works-internal improvements program. President Van Buren made his position on the issue abundantly clear: "To avoid the necessity of a permanent debt, and its inevitable consequences, I have advocated, and endeavored to carry into effect, the policy of confining the appropriations for public service to such objects only as are clearly within the constitutional authority of the Federal Government; of excluding from its expenses those improvident and unauthorized grants of public money for works of internal improvement . . . which, if they had not been checked, would long before this time have involved the finances of the General Government in embarrassments far greater than those which are now experienced by any of the States. . . ."[36]

From 1840 to 1860, the national internal improvement program faltered, or was renewed, with each change in administration. Van Buren paid the penalty for national depression when he was defeated for reelection in 1840. President John Tyler, though remembered as an advocate of states' rights and a strict-constructionist, did approve of some limited works of internal improvement. "The great importance of these subject," said Tyler, "to the prosperity . . . and the security of the whole country in time of war, can not escape observation," and during his administration work on some inland rivers was renewed, but not on the Cumberland.[37]

Colonel Stephen H. Long, whose intimate knowledge of western inland rivers made him the nation's foremost expert

"Parson" Brownlow

on their improvement, was given charge of river improvement operations on the inland waterways in 1842, with headquarters at Cincinnati, changed to Louisville in 1844.[38]

In 1843, he requested funds be provided for a survey of the Tennessee River aimed at planning a two-foot navigational minimum, improving Colbert Shoals and the Suck, and repairing the rapidly disintegrating canal at Muscle Shoals which Alabama had abandoned five years before. But the Chief of Topographical Engineers, J. J. Abert, had to exclude Long's request for a survey of the Tennessee from the Bureau's budgetary estimates. He admitted that the improvement of its navigation was both necessary and feasible, but he could not include funds for the survey in the budget because it had not been ordered by the War Department or Congress.[39]

Congress enacted a rivers and harbors bill in 1846 which appropriated nearly one and a half million dollars for waterways, but President James K. Polk of Tennessee vetoed the bill because he questioned its constitutionality. Most Engineer officers were sent in 1846 to

Mexico where they rendered memorable services, but with the close of the war in 1848 the issue of federally financed civil works again became an important political question.[40]

Support of a program of waterway improvements by the United States helped elect the Whig administration, President Zachary Taylor and Vice President Millard Fillmore, in 1848. Fillmore, who succeeded to the presidency after Taylor's death in 1850, said frankly: "I entertain no doubt of the authority of Congress to make appropriations for leading objects in that class of public works comprising what are usually called works of internal improvements."[41]

With this support from the executive branch of government, waterways improvements were resumed on a large scale in 1852, the final year of the Fillmore administration. Two and a quarter million dollars were appropriated, with $50,000 specifically authorized for expenditure on improvement of navigation on the Tennessee River—the first direct appropriation of Federal funds for the improvement of the Tennessee.[42]

Politics, however, in its very worst connotation, both motivated and sabotaged the project for the improvement of the Tennessee of 1852-1854.

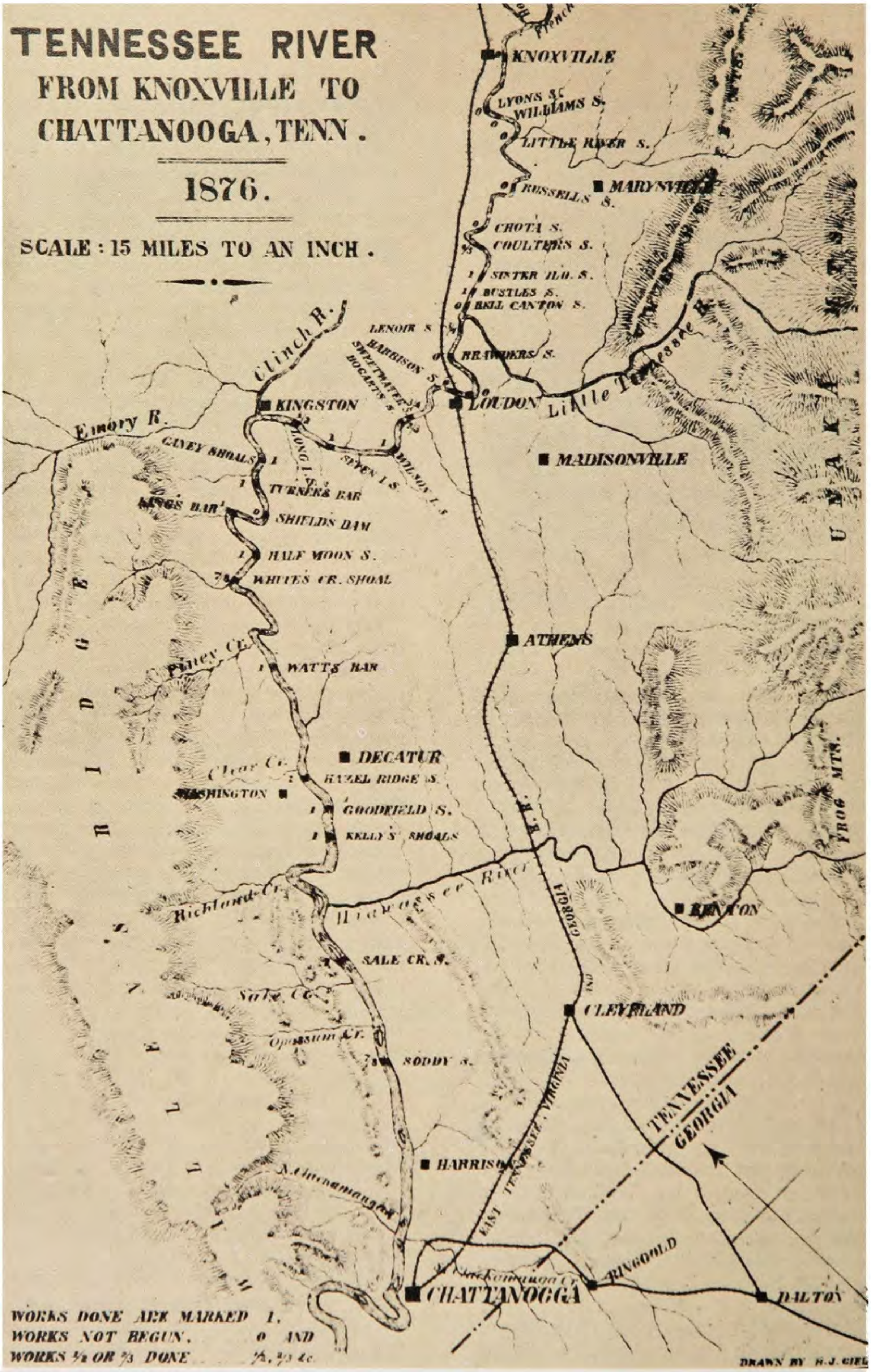
Ports of entry had been established at Knoxville and Chattanooga, Tennessee, apparently to circumvent the scruples of those who believed the improvement of rivers should be limited to streams located below ports of entry. But political machinations were most evident in the appointments which were made to posts connected with the improvement project. Most notable was the appointment of William G. "Parson" Brownlow, violently partisan editor of the *Knoxville Whig* and later Reconstruction governor of Tennessee, to the top civilian post, Agent in Charge of the Improvement of the Tennessee, by the outgoing Whig Secretary of War. Of course, the Engineer officer who was assigned to the Tennessee River Improvement Project, Lieutenant Colonel John McClellan, knew nothing of this until he arrived at Knoxville in the spring of 1853.[43]

Colonel McClellan, one of the most warmly human Engineer officers ever to serve on the twin rivers, served in the artillery from 1826 to 1836, was appointed to the Topographical Engineers in 1838, and won brevets several times for his gallantry in action during the Mexican War. In 1850, McClellan was appointed chief topographical engineer to the Mexican Boundary Commission under the direction of Commissioner John R. Bartlett. On the sea trip from New York to Texas Colonel McClellan had harsh words with several colleagues because of their inhumane treatment of subordinates, quarreled with Commissioner Bartlett because civilian workmen on the expedition were forced to eat their meals from tubs of food on the deck of the ship, and squabbled with a naval lieutenant over harsh punishments meted out to sailors who had celebrated shore leave in traditional navy fashion. The lieutenant proceeded to Washington to file charges against McClellan.[44]

After the company reached Texas and the survey began, the Colonel was embroiled in a continuous dispute with the quartermaster over food quality, treatment of the men, selection of camp-sites, and so forth, and Commissioner Bartlett requested his resignation, threatening charges of drunkeness and misconduct. The Colonel was not at all cowed—he demanded a court martial and placed counter charges against the Commissioner. For the sake of peace on the survey, McClellan was recalled and relegated to the quiet hinterland of East Tennessee, in charge of the improvement of the Upper Tennessee.[45]

Thus, when the Colonel reached Knoxville in April of 1853, he was in no mood to brook any usurpations of his authority, and he was shocked to discover that Secretary of War C. M. Conrad of the Whig administration of President Fillmore had, as one of his last acts of office, appointed several political hacks as assistants on the Tennessee River Project and had made "Parson" Brownlow the Agent in Charge.[46]

Colonel McClellan immediately fired letters back to headquarters in Washington. What am I to do with such incompetent assistants, he asked, "not one of whom knows any thing of what he is to be employed at," but all of whom



1876 map of Tennessee River from Knoxville to Chattanooga showing sites of work performed by Colonel John McClellan in 1853-54.

expect pay from the date of employment. He complained their high rate of pay, at four dollars per diem, had caused the mechanics to demand three dollars per day, and he predicted the Tennessee River Project might become the "most expensive ever undertaken by the government."[47]

And what about the Agent in Charge, "Parson" Brownlow, he queried, "if I am to disburse the money, and superintend the operations, what is he to do?" Brownlow knows nothing about engineering at all, McClellan complained, and the Colonel respectfully tendered his resignation from the Tennessee River Project and requested transfer to the cooler climes of Lake Michigan.[48]

Naturally, there was considerable comment about the situation among the "Parson's" political opposition, who asked: "Will the [President Franklin] Pierce dynasty remove Brownlow, or permit him to remain. We shall wait the result with anxiety." Brownlow, although a Whig, had opposed General Winfield Scott, the Whig presidential candidate in 1852, and the Scott Whigs were rather anxious that Brownlow be removed from

Colonel McClellan (d) was buried at Knoxville.

the sinecure on the Tennessee River Project which the Fillmore administration had given him. There were Democrats, on the other hand, who requested the new Secretary of War, Jefferson Davis, to allow Brownlow to remain in office. One wrote Davis it was important to the Democratic party in Tennessee that Brownlow be retained in his office, at least until after Tennessee's gubernatorial election of 1853, for "without the aid of B. I fear we cannot carry the State, with his influence we can."[49]

The actual resolution of Brownlow's situation has not been discovered, but since he was not mentioned further by Colonel McClellan in his correspondence and Brownlow's biographer did not mention the job at all, it is assumed that Brownlow was removed.[50]

But the Parson's predicament was merely the tip of the political iceberg Colonel McClellan found hidden in the waters of the Tennessee. Chattanoogans had opposed the creation of a port of entry at Knoxville in order to secure the entire appropriation for the improvement of the Suck below Chattanooga; nevertheless, Knoxville had been established as a port of entry. When Colonel McClellan was ordered by the Topographical Bureau to begin the improvement project at Knoxville and work down river, the political leaders of Chattanooga were enraged. One wrote the new Secretary of War, Jefferson Davis of the Democratic party, that if some change were not made in the plan of improvement "it will injure the democratic party in the coming election." No such change was made.[51]

Further political chicanery was attempted in June of 1853 when Congressman W. M. Churchill of Tennessee urged the Secretary of War to employ a man as assistant engineer on the Tennessee River Project because he was "an old time Democrat, has worked long & faithfully in the party, and is worthy of an office." The letter was passed along to Colonel McClellan at Knoxville who quickly retorted the man recommended was an "old man, unfit for active service, and destitute of knowledge of the river, and I know no station on the work the duties of which he could perform to

advantage. . ." The Colonel employed, instead, an experienced river pilot in the position.[52]

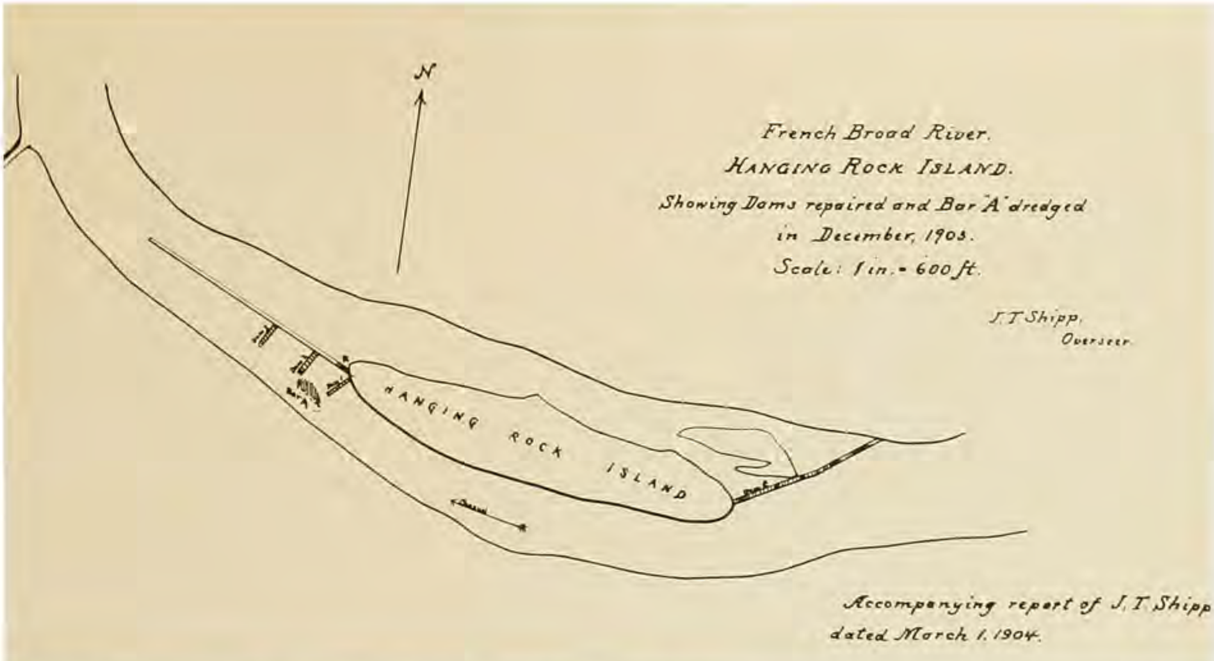
With the political obstructions circumvented, Colonel McClellan prepared to assault the obstructions actually in the river's channel. On July 1, 1853, scows crowded with 140 laborers set out from Knoxville down river to go to work. Throughout the summer and fall of 1853, the Engineers constructed wing dams at Knoxville Shoals, Chota Shoals, Booth's Shoals, Winston's Shoals, and other locations on the Upper Tennessee; they removed timbers and logs from the channel and the banks from Knoxville to the Alabama state line; and they blasted a two-foot minimum channel through the rocky river bottom.[53]

Handling explosives is always dangerous and two of the workers on the Tennessee were seriously injured by an accidental detonation. The Colonel requested permission to pay their medical expenses with funds for the project. He explained to Washington that he would direct the men to pay their own bills and then recompense them afterwards for fear the knowledge that the government would pay the bills might increase them, and permission was granted by the Chief's office.[54]

The improvement above Chattanooga, except for the explosion, appears to have proceeded smoothly, but the improvement of the Suck, where Assistant Engineer Philip Van Wyck had lost his life twenty years before, struck a snag. Colonel McClellan planned to blast a channel through the Suck to create a sluice, but his proposal met opposition.[55]

Lieutenant Colonel James Kearney,

Early Engineer snagboat clearing trees from the Cumberland River at Jones Island upstream from Nashville.



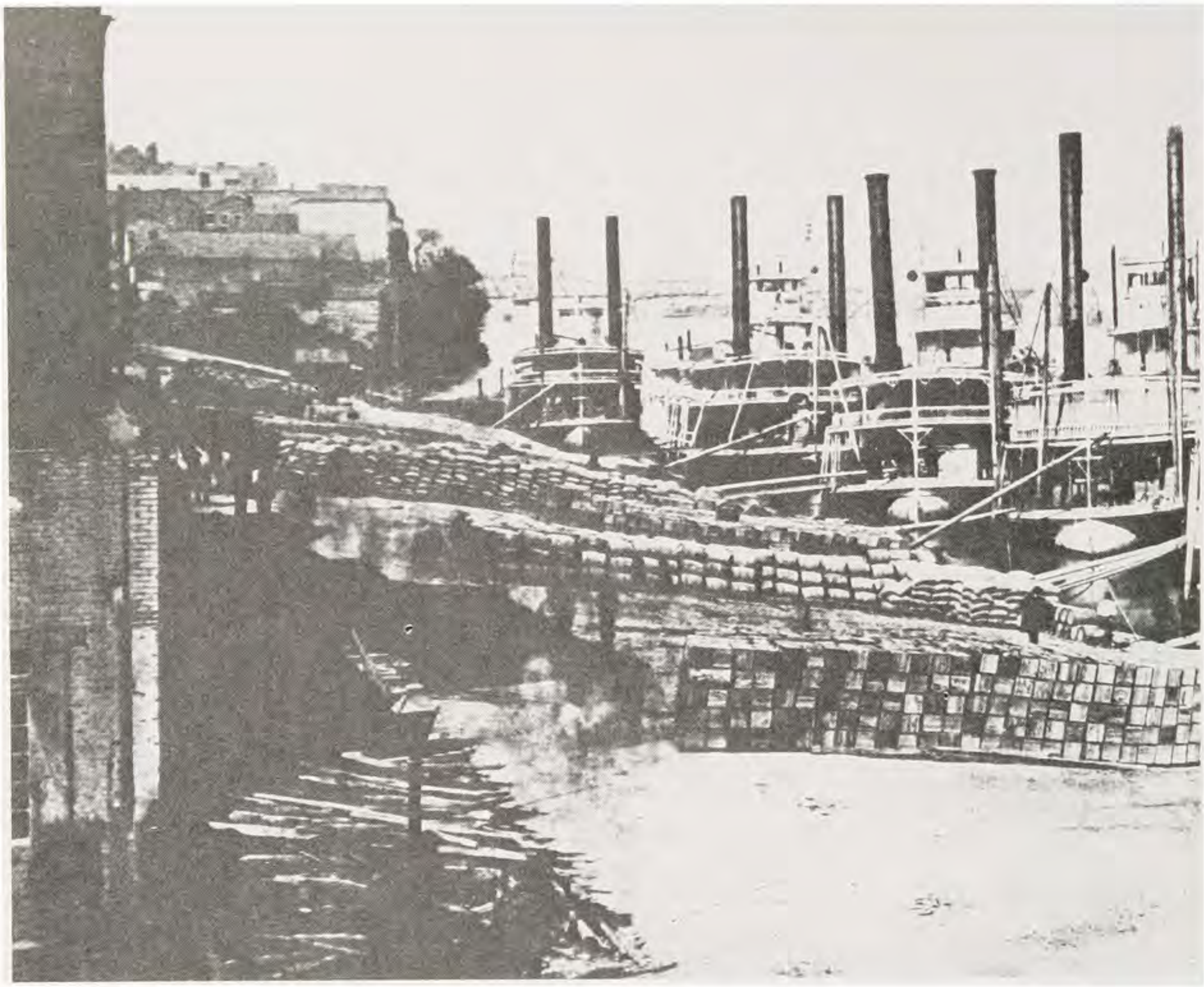
A 1904 Engineer map of the notorious Hanging Rock Island Shoals, an obstruction much feared by flatboatmen, on French Broad River.

president of the Board of Engineers for Lake Harbors and Western Rivers and a man with long experience in waterways improvement (it will be recalled he had surveyed the Muscle Shoals Canal two decades before), heartily disapproved of the plans for the improvement of the Suck. He demanded an explanation from Colonel McClellan of his reasons for departing from the plans for the Suck prepared by Colonel Stephen H. Long in 1832. Colonel McClellan's explanations were not satisfactory and his plans at the Suck were rejected, the Board of Engineers claiming that to blast a channel through the Suck would merely lower the surface level of the pool above and create a new shoal.[56]

From April to August of 1854, Colonel McClellan continued operations on the Upper Tennessee of the same variety he had executed the previous year, but in August he received the bad news: President Franklin Pierce had vetoed the Rivers and Harbors Bill. The Pierce administration rejected the view that the creation of a port of entry justified the improvement of the river below it, and Pierce, who consistently opposed internal improvements at Federal expense, explained that only improvements of clear military necessity, or the installation of safety devices, such as lighthouses, were, in his opinion, of undoubted constitutionality.[57]

Colonel McClellan paid off and discharged the workers on the Tennessee River Project, and was closing the project's accounts when he was suddenly stricken by the dread cholera. On the evening of August 31, he was his usual cheerful self and apparently in good health, but he became ill during the night and died just before noon the following day. The Colonel was interred in the Gray Cemetery at Knoxville, and his nephew, R. W. W. Byrd, sorrowfully closed the books on the pre-Civil War improvement of the Tennessee. They were not to be reopened until after the questions concerning Federal powers were settled by force of arms.[58]

The navigational improvements which Colonel McClellan did accomplish before his untimely death proved to be remarkably durable, for in 1920 the Chattanooga District Engineer reported that parts of the dams constructed in 1853-1854 were still in service and "visible to this day although for the most part they have been covered by later works."[59]



Nashville wharf, 1862.

The improvement of the nation's inland waterways languished during the few remaining years before the angry artillery around Fort Sumter resounded across the nation, and during those years no work at all was accomplished towards the improvement of navigation on the twin rivers. From 1853 to 1860 more than 3,000 people lost their lives in accidents on the inland waterways and river commerce nearly doubled, but the nation was preoccupied with matters other than the improvement of navigation. The office of Superintendent of Western River Improvement was abolished in 1856, and Colonel Stephen H. Long was assigned the direction of projects along the Lower Mississippi. He was appointed Chief of Topographical Engineers in 1861, the last to serve in this capacity before the Topographical Bureau was merged with the Corps of Engineers in 1863.[60]

The failure of the nation to improve its inland waterways, known then as the western rivers, especially the Cumberland and Tennessee, in a manner adequate for navigation was to be a matter of serious regret to Union generals during the Civil War. Muddy, bottomless roads and a railway service continually disrupted by partisans and intrepid Confederate cavalry units forced the armies of the United States to rely heavily on the twin rivers during the campaigns up the twin valleys into the heartland of the Confederacy. The twin rivers, in spite of the obstructions to navigation littering their channels, became logistical lifelines supporting the advance of the Union armies, but on many occasions low-water disrupted Union supply operations.

CHAPTER V

CIVIL WAR COMBAT ENGINEERING

From 1861 to 1865 the Army Engineers engaged in major military construction activities and combat operations throughout the country. Topographical Engineers spearheaded the movements of the armies, reconnoitering the terrain to assess its offensive and defensive possibilities, prepared maps for the use of field commanders, and directed the construction of roads and bridges. Officers of the Corps of Engineers led combat engineer units, supervised the construction of fortifications, railroads, and support facilities, and in many cases were assigned to the command of troops of the line. Many commanding generals in both Union and Confederate armies —Robert E. Lee, P. G. T. Beauregard, Joseph E. Johnston, George Meade, John Pope, William S. Rosecran, as examples—had served as Engineer officers in the United States Army before the war. Roads, railroads, bridges, and major fortifications were constructed throughout the Cumberland and Tennessee valleys by both Confederate and Union Army Engineers; activities which were to have significant influence on the course of the war.

Both Union and Confederate armies suffered from a shortage of trained and experienced Engineer officers during the war. There were only ninety-three Engineer officers in the United States Army in 1861, and fifteen of these resigned to join their home states in the Confederacy. The Confederacy also recruited many civil engineers for its Engineer Corps, but Confederate armies, particularly in the Cumberland and Tennessee valleys, were continually handicapped by a scarcity of experienced Army Engineers. The Confederate Engineer Corps, created on March 6, 1861, consisted of ten officers, plus noncommissioned officers and enlisted men. Its size increased as the war progressed, but it was never adequate for the needs of field commanders and only the Third Confederate Engineer Battalion of the regular Confederate Army Engineers ever served in the Cumberland and Tennessee valleys (with General John B. Hood in 1864). The Confederate Chief Engineer explained in 1862 that he had no Engineer officers to send to General Braxton Bragg in the West, for of the thirteen officers then in the Corps "7 have been assigned to duty beyond the line of their immediate profession, leaving but 6 for engineer service."[1]

Confederate Engineers conducted the first military construction activities in the Cumberland and Tennessee valleys in 1861, and these activities were carried out by civil engineers recruited by the Army of Tennessee. In May, 1861, the Governor of Tennessee selected Adna Anderson and Wilbur F. Foster, two civil engineers with considerable prewar railroad construction experience, to locate and initiate construction of fortifications for the twin rivers. The two men selected the site of Fort Donelson on the Cumberland, then crossed to the Tennessee River to investigate potential sites. The site they selected on the Tennessee was rejected by Bushrod R. Johnson, chief engineer of the Army of Tennessee, in favor of another site nearer the Kentucky state line. Major (later General) Bushrod Johnson was a graduate of West Point, but his service as a supply officer during the Mexican War and as administrator of a military academy had provided little engineering experience, and the site he

General U. S. Grant's engineers built the longest — nearly a mile — floating bridge in world history across the Ohio River at Paducah in 1861.

Union fleet advances on Fort Henry, 1862.

selected for Fort Henry was commanded by hills on the opposite side of the river and was subject to flooding.[2]

As Union gunboats began to stream up the Cumberland and Tennessee in late 1861 to test Confederate defenses, the Confederate commander in the West, General Albert S. Johnston, pleaded for additional Engineers: "The necessity of engineers is pressed on my attention by the wants of every hour. Can they be furnished? If not, can I muster the engineers of Tennessee, if to be had?" The Secretary of War replied:

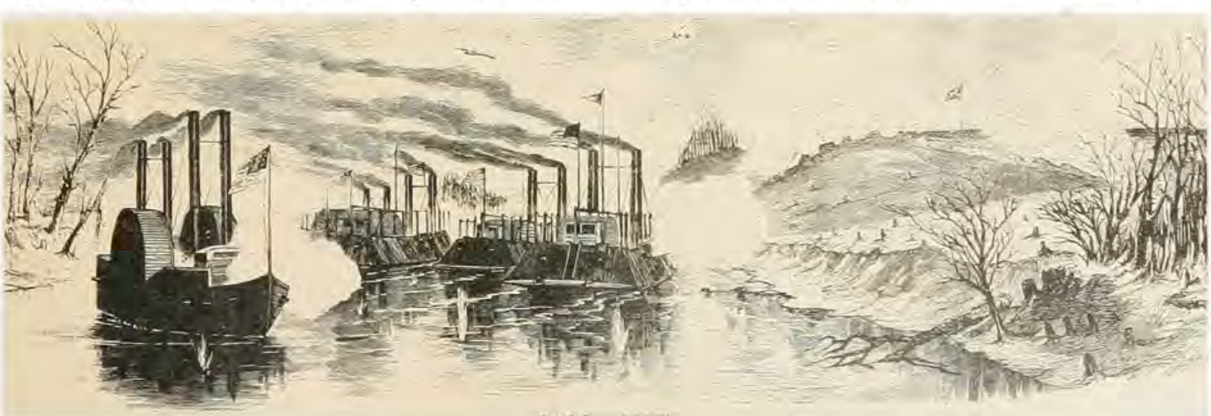
> We have not an engineer to send you. The whole Engineer Corps comprises only 6 captains together with 3 majors, of whom 1 is on bureau duty. You will be compelled to employ the best material within your reach by detailing officers from other corps and by employing civil engineers, for whom pay will be allowed.[3]

In the crisis, the Confederate Chief Engineer himself, Major (later General) Jeremy F. Gilmer, reported to General Johnston, who ordered the Chief Engineer to prepare the Cumberland River defenses against attack. At Nashville he laid out a small fort below the city (Fort Zollicoffer) to command the approach by water and selected three sites on pikes north of the city for combined camps and fortifications. He left a civil engineer in charge of construction and proceeded to Clarksville, where he laid out a river battery and field works to guard the approach by road from the north. Again he left a civil engineer in charge of construction and moved to Fort Donelson where he placed Captain Joseph Dixon, an Engineer officer who had previously directed fortification construction on the Mississippi River, in command of the work force that was rushing the work at Fort Donelson.[4]

The fort on the Cumberland was ringed by rugged terrain and dense timber which could make defense against an attack by land difficult. Major Gilmer and Captain Dixon remedied this defect by laying out trenches and rifle pits in an outer line encompassing the fort and the town of Dover and by slashing down the surrounding forest to create a crude abatis and open a field of fire. Captain Dixon mounted an additional battery bearing on the river and mounted two small cannon on the landward side of the fort.[5]

Fort Henry, a pentagonal, open-bastion work mounting seventeen guns, was the first fortification attacked by Union forces in Tennessee. Union gunboats forced the surrender of Fort Henry after a sharp artillery duel on February 6, 1862. The fort would have fallen in any case shortly thereafter because the rising Tennessee River was inundating it. Major Gilmer, who was within Fort Henry when it was surrendered, noted the effect of the fire of the gunboats on the fortification and slipped out with his information, swimming the backwaters of the swollen Tennessee to escape to Fort Donelson. At Donelson, he and Captain Dixon sandbagged the embrasures and parapets in front of the river batteries until the Union flotilla steamed up to attack the fort.[6]

On February 13, a single Union gunboat tested the fort, and Captain Joseph Dixon, who had charge of the fort's ordnance, became the first casualty of the Battle of Fort Donelson when a shell from the gunboat entered the embrasure where he stood and killed him instantly. The entire Union fleet made its assault on the following day, but effective fire by Confederate guns from behind strong fortifications disabled most of the Union fleet, which was saved from destruction by the current of the Cumberland which



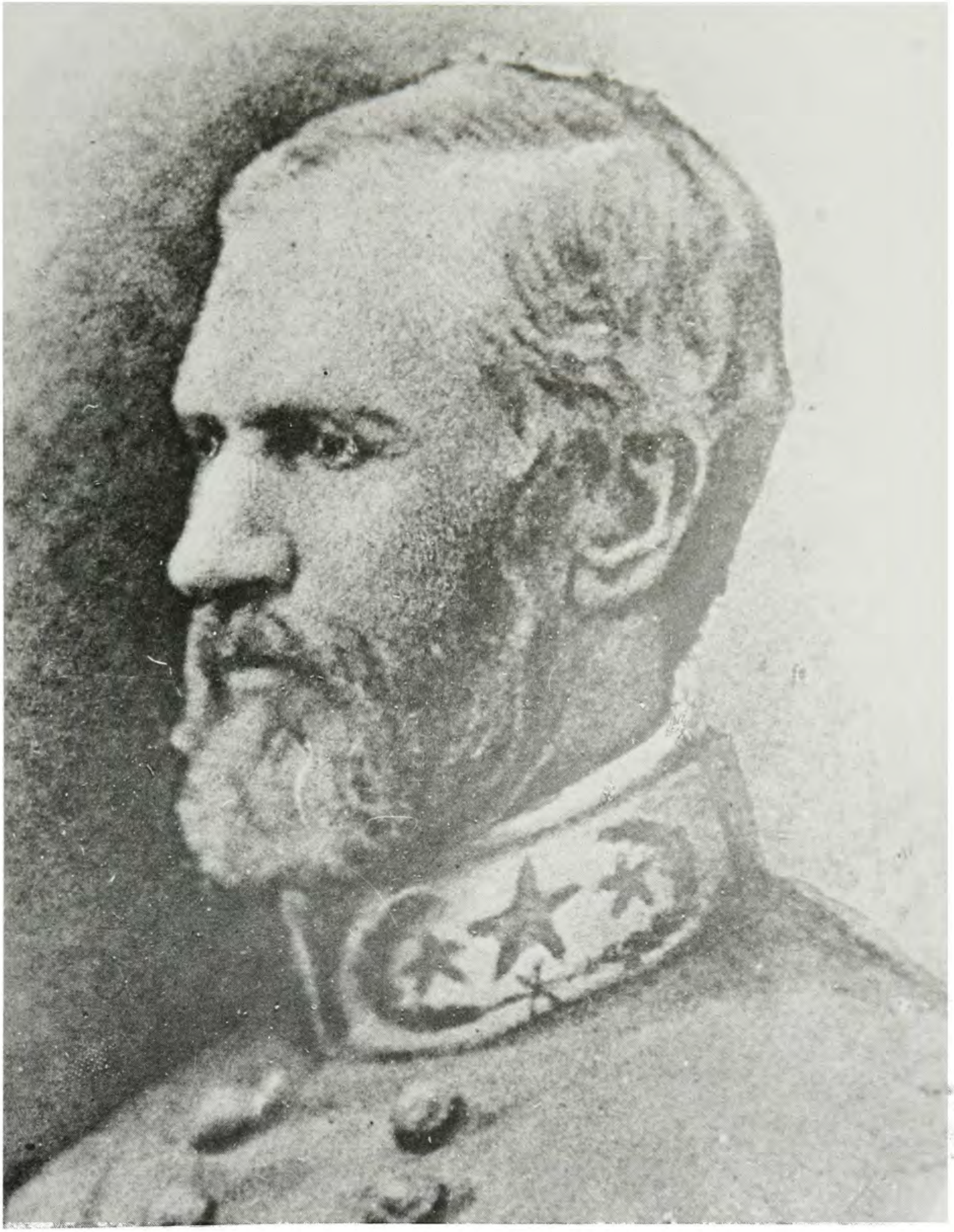
Union fleet attacks Fort Donelson, 1862.

swept the boats down river to safety. The Union army prepared for a prolonged siege, which the formidable character of the defenses at Fort Donelson seemed to dictate, but to the chagrin of the Confederacy the fort and much of the army within surrendered unconditionally on February 16 after a siege of only two days. There is little doubt that this capitulation was due to unwise command decisions and not to defective fortifications.[7]

General Albert S. Johnston at Bowling Green, Kentucky, had concluded that the Confederate defensive line across southern Kentucky was untenable after the fall of Fort Henry and had ordered a withdrawal south, because, he said, the "probability of having the ferriage of this army corps across the Cumberland intercepted by the gunboats of the enemy admits of no delay in making the movement." When the army reached Nashville, it found the city was not defensible, because its fortifications had never been completed. The slave work force which was to construct the defensive works had never been furnished, and Major Gilmer explained that the engineering problems were too numerous to be overcome in a reasonable time. The capital city, he said, located "in a wide basin, intersected by a navigable river in possession of the invader; approached from all directions by good turnpike roads and surrounded by commanding hills, involving works of not less than 20 miles in extent, the city could not be held by a force less than 50,000."[8]

Thus, by April, 1862, the Cumberland Valley and the Lower Tennessee Valley had been taken and occupied by Union forces in spite of Confederate efforts to fortify and defend them; indeed, it is possible the Upper Tennessee Valley might also have been taken had the Tennessee River not been closed to Union gunboats by obstructions at Muscle Shoals. The efforts of Confederate Engineers to fortify the valleys can only be assessed as failures. Fort Henry was improperly located, and even had the

How Fort Donelson controlled the Cumberland, 1862.

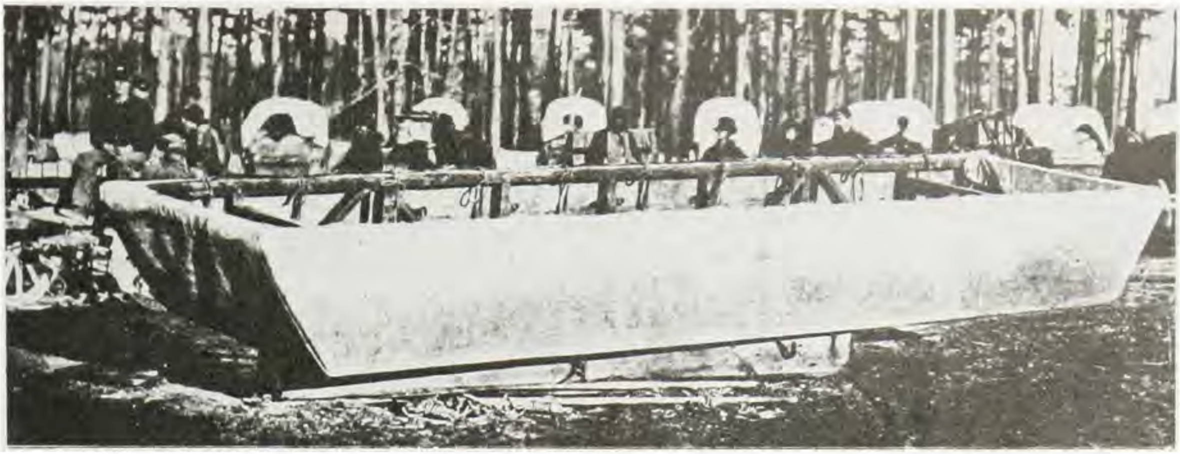


General Jeremy F. Gilmer, Chief of Confederate Engineer Corps, 1861-65.

Confederate attack on Union steamboat convoy at Harpeth Shoals, Cumberland River.

Union gunboats been driven off the fort would have capitulated to the floodwaters of the Tennessee River. Defensive positions at Nashville and Clarksville were not designed to resist a major seige, their construction was not completed, and they were abandoned without resistance. Fort Donelson, on which the Confederate Engineers labored most extensively, was defensible and could have been held for a longer period of time; but even it would probably have capitulated after a protracted seige. Hence, it may be asserted that an important cause of this early Confederate reverse in the twin river valleys was a shortage of trained Engineers and incomplete planning for a major defensive effort.

Union armies, on the other hand, were relatively well-supplied with experienced Engineer officers and capable Engineer units during the advance into the twin valleys. The Engineers of the command of General U. S. Grant conducted reconnaissance missions into the Confederacy before the campaign up the Cumberland and Tennessee valleys began, fortified Paducah and Smithland, Kentucky, at the mouth of the two rivers, and constructed the longest floating bridge *ever* constructed across the Ohio River at Paducah. The chief engineer of the expedition against Fort Henry and Fort Donelson was Lieutenant Colonel James B. McPherson, who was later given the command of an army corps which he led with conspicuous success in the cam-



Folding canvas ponton, designed by Colonel William E. Merrill, Army of the Cumberland, 1864.

paigns from Fort Donelson to Atlanta where he was killed in action in 1864. The army commanded by General Don Carlos Buell, which advanced on Nashville from Louisville, Kentucky, was preceded by Engineers on reconnaissance missions, notably Captain Frederick C. Prime, Corps of Engineers, who was wounded and captured while on one of these missions in 1862.[9]

The regular Engineer troops units of the Union Army served in the Eastern theatre, and in the West two volunteer Engineer units, the Pioneer Brigade and the First Michigan Regiment of Engineers and Mechanics, were recruited to serve in the Army of the Cumberland. The First Michigan Regiment of Engineers and Mechanics, 1800 men with prewar railroad and construction experience, was formed in 1861 by Colonel William P. Innes, a civil engineer. This unit served with the Army of the Cumberland, the command of General Don C. Buell and later General William S. Rosecrans and General George H. Thomas, throughout the war. The First Michigan specialized in railroad and bridge construction; in 1864 it took over the operation of the Nashville, Chattanooga, and St. Louis Railway. It distinguished itself in combat on several occasions, notably at the battles of Perryville, Kentucky, and Stone's River (Murfreesboro), Tennessee. Its action at Stone's River provides ample testimony to its capability as a combat unit.[10]

During the Battle of Stone's River at the end of 1862, the First Michigan Engineers were repairing roads and railroad communications in the rear of the Union army, but the threat that Union supply lines from Nashville would be severed by Confederate cavalry, under the command of General Joseph Wheeler, altered their mission. Colonel William Innes and 391 men of the First Michigan stationed themselves at LaVergne, on the road between Nashville and the battlefield, and erected a barricade of cedar brush atop a nearby hill. On New Year's Day, 1863, Confederate troopers swept up to this position from

Pontons were transported by wagon, 1862.

Union Army Engineers bridge the Tennessee River at Browns Ferry under fire in October 1863.

Union Army Engineers launch pontons in October 1863 for amphibious assault down Tennessee River from Chattanooga.

the south to attack Union supply wagons along the Nashville pike. There were several thousand cavalrymen and a few pieces of artillery, and, since the Confederates were in overwhelming force, a surrender was demanded from the detachment of Engineers. However, Colonel Innes replied to the officer bearing the demand: "Tell General Wheeler I'll see him damned first. We don't surrender much! Let him take us." This the Confederates proceeded to attempt, opening up on the Engineer position with artillery and making seven separate assaults, but they were unable to break through the cedar barricade and withering fire of the ring of Engineers. The First Michigan suffered eleven casualties in the action and the Confederates may have lost as many as fifty men.[11]

The second unit of Union volunteer Engineer troops which served principally in the Cumberland and Tennessee valleys was the Pioneer Brigade, later named the "First United States Veteran Volunteer Engineers." The Pioneer Brigade was organized by General William S. Rosecrans shortly after he took command of the Army of the Cumberland in October 1862; he instructed each regimental commander to select the two best men from each company and place them under the command of a Lieutenant, preferably one with prewar experience as a civil engineer. These men, about 3000 in number, were brigaded under the command of Captain James St. Clair Morton, chief engineer of the Army of the Cumberland, and Captain Morton assembled them in Nashville in November, 1862, for training. Three battalions were authorized, one for each wing, or corps, of the Army of the Cumberland, and the unit was equipped with some fifty wagons of tools—axes, saws, picks, hammers, augers, ropes, and nails—plus an eighty-boat ponton train. Where the First Michigan Engineers operated principally in a support role, in charge of road and railroad construction, the Pioneer Brigade was organized for front line duty, opening roads and bridging rivers for the advance of the army. The Pioneer Brigade also distinguished itself on several occasions in combat action. At the Battle of Stone's

General James St. Clair Morton of the Pioneer Brigade (First U.S. Volunteer Engineers).

Colonel William P. Innes of First Michigan Engineers.

Union Engineers bridged the Tennessee River at Bridgeport, Alabama.

River it took and held an important position against heavy Confederate attack, and as a result the Brigade was increased to four battalions and its commander, Captain Morton, was immediately promoted to brigadier general.[12]

The significance of the services of these two volunteer Engineer organizations should not be underestimated, for, though few in number, their contributions to the success of the Union armies in the twin valleys were major. No units of regular Engineer enlisted men served in the twin river region, and the volunteer Engineers, plus details of infantry in emergencies, were responsible for facilitating the movement of the armies, by clearing roads and placing ponton bridges, and for keeping the logistical lines open for the transportation of supplies to the front. The latter portion of their mission necessitated extensive railroad and bridge construction, the construction of warehouses at Union depots, and the fortification of practically every major town in the Cumberland and Tennessee valleys.

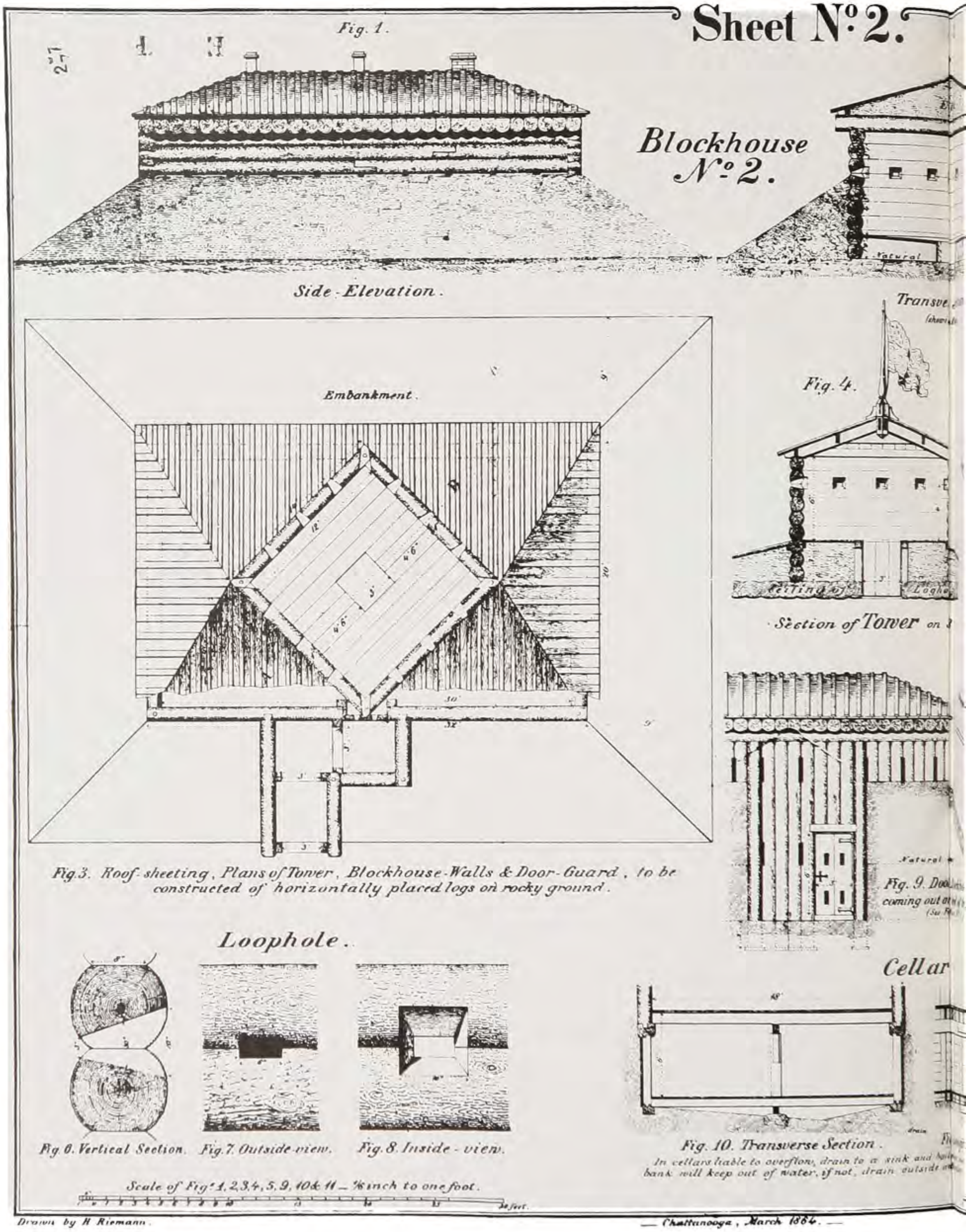
During the summer of 1862, General Don C. Buell was planning an advance from Middle Tennessee and Northern Alabama to Chattanooga, and this movement depended upon the establishment of a solid logistical line from Nashville by railroad, because obstructions in the Tennessee River prevented reliance on the river for provisions. Captain James St. Clair Morton was ordered to design defenses for the railroads, for Confederate units were burning bridges as rapidly as the First Michigan Engineers could construct them. Octagonal stockades, twenty-five to forty feet on a side, were planned at each railroad bridge to house a small garrison charged with the defense of the bridge, and Captain Morton rushed construction, traveling to the sites by train, laying out the works, and leaving them for the First Michigan Engineers, or the garrison force, to complete. A large number of these crude fortifications were being

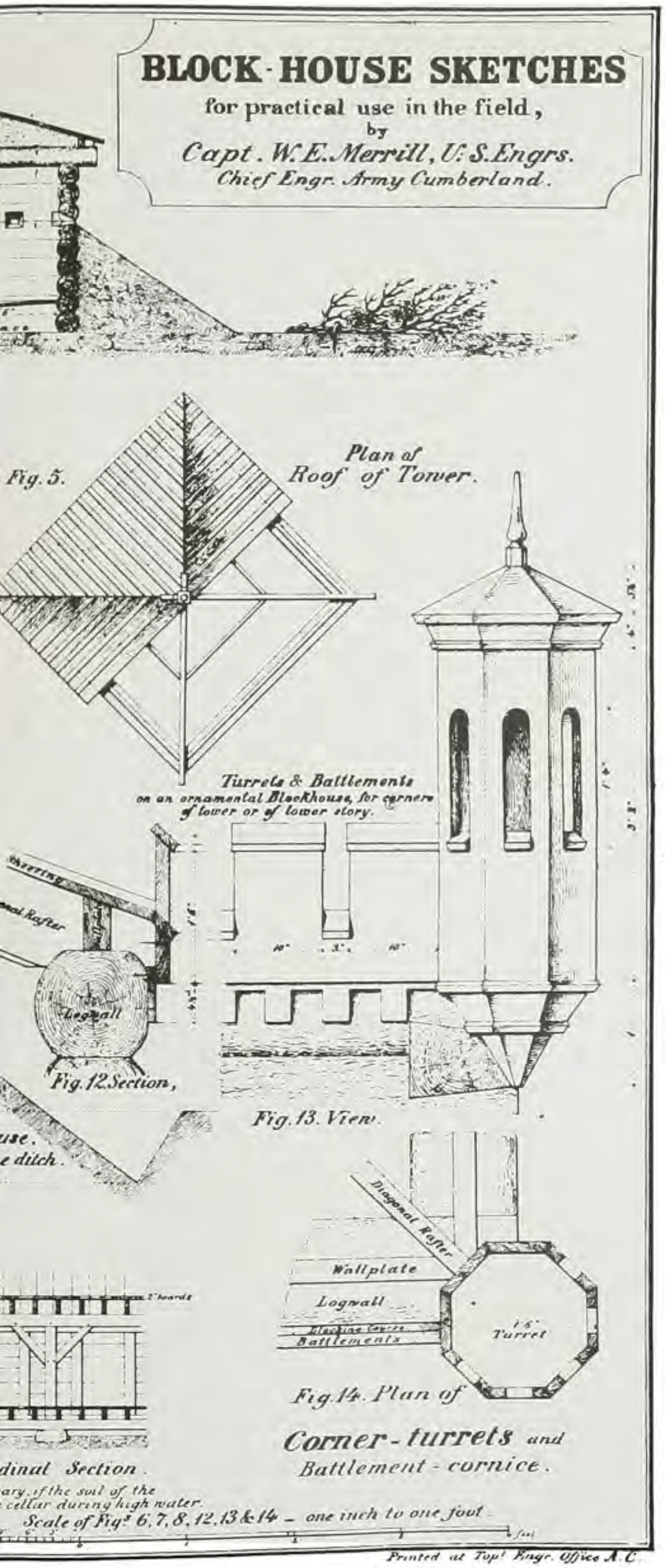
erected when the Confederate army flanked the Union army by marching across the Upper Cumberland Valley into Kentucky, forcing the withdrawal of the main body of the Union army north in pursuit. As a result, most of the just-completed stockades were abandoned and destroyed. Some of the stockades were attacked and proved inadequate, for though they were sufficient protection for small garrisons against infantry and cavalry attack, they became slaughter pens under artillery fire because of flying splinters.[13]

Another attempt was made by Union Engineers to provide adequate defenses for railroads in 1864. Captain William E. Merrill, Corps of Engineers, and Lieutenant Colonel Kinsma A. Hunton, First Michigan Engineers, experimented with an old stockade at LaVergne, Tennessee, to determine how best to improve its capability under artillery attack. After hitting it a number of times with six-pound shot, the two officers decided to build double-walled, roofed blockhouses designed to secure at least forty inches of protection for the garrison. Captain Merrill and his staff designed an octagonal blockhouse with thick, double-walls and turrets to provide better surveillance of the surrounding terrain; however, most blockhouses were actually constructed on a rectangular plan minus the turrets because of the exigencies of time and manpower. Each blockhouse was furnished with ventilators, cellars, water-tanks, and bunks for the garrision, and some were even two-stories high. About 150 such structures were constructed along rail lines in the Cumberland and Tennessee valleys, and massive blockhouses with earthen ramparts to shelter artillery units were erected at vital bridges across the Tennessee River.[14]

The value of the blockhouses soon became evident. One forced the Confederate army of General John B. Hood to march twenty miles out of its way to bypass it in 1864; another, was attacked in force by cavalry under General Joseph Wheeler and a third of the garrision was killed, but the remainder of the men held out and saved their bridge. Only General Nathan B. Forrest dealt effectively with the blockhouses. He shelled a blockhouse on the Nashville to Decatur rail line and the garrison cravenly surrendered. The prisoners were paraded before several other blockhouses to prove they could be taken and the garrisons capitulated without resistance. One unit did refuse to surrender and General Forrest directed an assault to keep the garrison occupied while his men slipped up to the bridge and tossed a sort of firebomb. The Union garrison kept their blockhouse; Forrest burned the bridge. In general, however, the blockhouses proved formidable when occupied by determined troops—one, for example, held out for two weeks and saved its bridge, though besieged by a Confederate division and hit seventy-two times by artillery shells. On the Nashville and Chattanooga railroad, the main line of Union logistics, only six bridges were destroyed after the construction of the blockhouses, and those were abandoned on the approach of the army of General Hood into Middle Tennessee in late 1864.[15]

In providing for movement of the army, Union Army Engineers in the Cumberland and Tennessee valleys made two engineering innovations of note. The first was the development of the hinged, canvas ponton boat. Early in the war both Union and Confederate armies used heavy wooden ponton boats which required specially-constructed wagons for movement. During the course of the war, Union Engineers adopted the canvas-covered, wooden-frame ponton which was lighter and more mobile. Captain William E. Merrill, chief engineer to General George H. Thomas, added a hinge to the framework of these canvas pontons so they might be broken down for transportation in regulation army wagons without disassembling the framework. This type of ponton became standard in the western armies and accompanied General William Sherman's army during the campaigns through Georgia and the Carolinas. They were put down, taken up, and put down time and again, as the Union Engineers laid approximately 17,680 feet of ponton bridging during General Sherman's campaigns.[16]


Sheet No. 2.
Fig. 1.
Blockhouse
No. 2.
Side-Elevation.
Embankment.
Fig. 4.
Fig. 3. Roof-sheeting, Plans of Tower, Blockhouse-Walls & Door-Guard, to be constructed of horizontally placed logs on rocky ground.
Loophole.
Fig. 6. Vertical Section.
Fig. 7. Outside-view.
Fig. 8. Inside-view.
Scale of Fig's 1, 2, 3, 4, 5, 9, 10 & 11 — 3/8 inch to one foot.
Cellar
Fig. 10. Transverse Section.
Drawn by H. Riemann.
Chattanooga, March 1864.



The second significant engineering innovation was in topographical mapping. Because the Army of the Cumberland operated so far from Engineer headquarters in Washington, D. C., it had its own complete map-production facilities: a printing press, two lithographic presses, one photographic reproduction facility, and a full staff of draftsmen and assistants. Early in the war, maps for field use were reproduced photographically, but these proved unsatisfactory because they blurred at the edges and were replaced by maps produced by lithography. This method was also unsatisfactory because the lithographic stones and presses were too heavy for movement with the army. Captain William C. Margedant, chief assistant to Captain Merrill, invented a photo-printing device to meet this exigency, which consisted of a light-weight box containing several india-rubber baths, which fit one into another, and the proper supply of chemicals. Printing was accomplished by tracing the required map on thin tissue paper and placing it over a sheet coated with silver nitrate. The rays of the sun, passing through the tissue paper, blackened the silver-nitrate paper except under the ink lines on the tissue paper, thus creating a white map on a black background. This device facilitated the rapid reproduction of copies as often as new information was revealed by reconnaissance and intelligence operations, and at times there were several editions of a map in a single day.[17]

This mapping technique gave the Union army a superiority in topographical mapping which contributed much to the success of the Tullahoma campaign of General Rosecrans and later to General Sherman's march to Atlanta and the sea. General maps were produced on a scale of an inch to the mile, and detaiis were filled in by interrogating prisoners, spies, local residents, and by reconnaissance. Every commander down to brigade level in the Army of the West was furnished with relatively reliable maps, with copies for use by cavalry officers printed directly onto muslin to mitigate the effects of hard service. The value of this innovation was recognized by the

commanding general of the Army of the Cumberland, William S. Rosecrans, who declared after the Tullahoma campaign the Margedant process "contributed very greatly to the ease and success of our movements over a country of difficult and hitherto unknown topography."[18]

At the time of the Civil War, the services of the Engineers were probably most important during major sieges, both to the attacking force and to the defenders. The force laying the siege required competent Engineers to plan the investment, lay out the lines around the fortress or city under siege, and reconnoiter the topography of the area and the enemy's position. The force under siege utilized the services of Engineers in fortifying the position, arranging for adequate defenses against assault, and in probing the position of the force laying the siege in search of ways to keep supply lines open. During the course of the war, Union Engineers fortified the major cities and towns of the Cumberland and Tennessee basins, and three of these cities—Chattanooga, Knoxville, and Nashville, Tennessee—were besieged by strong Confederate forces. It was during these three sieges, or battles, that the worth of an adequate force of Army Engineers to the Union armies was most apparent, and these sieges also revealed the handicap imposed on Confederate operations by the scarcity of trained and experienced Army Engineers.

At the Battle of Chickamauga in September, 1863, the Army of the Cumberland commanded by General William S. Rosecrans was badly defeated by Confederate forces under the command of

Blockhouse constructed by the Corps of Engineers at Chattanooga in 1864.

Fort Negley, Nashville, 1864.

Interior of Fort Negley, Nashville, 1864.

Fort Andrew Johnson, Tennessee State Capitol Nashville, 1864.

Union Army Engineers repaired and fortified the railroad bridge over the Cumberland at Nashville.

General Braxton Bragg, and it retreated into Chattanooga while Confederates occupied the heights around the city to lay siege. Brigadier General James St. Clair Morton, Rosecrans' chief engineer, supervised the hasty fortification of Chattanooga, directing the work of the entire army in the effort. Chattanooga was soon surrounded by an arc of earthworks from the Tennessee above the town back to the river below. After forty-eight hours construction, it was estimated the city could have been held by a force of only ten thousand men, but the Union army in Chattanooga soon discovered that holding the city was not the problem, for the victorious Confederates on the heights above chose to let them keep it—until they starved.[19]

In October, General William F. "Baldy" Smith replaced General Morton as chief engineer of the Army of the Cumberland (Morton transferred to the Virginia theater where he was killed in action before Petersburg in 1864). The problem to which General Smith directed his attention was opening supply lines into the beleaguered city, for Confederates controlled the logistical lines and the Union army was on short rations. On October 19, General Smith reconnoitered the Tennessee River below the city in search of a way to open it into Chattanooga for Union supply transports. Across the neck of Moccasin Bend from the city, he observed a break in the range of hills on the south side of the river, controlled by Confederate forces, through which ran a road leading to Kelley's Ferry, which was accessible to Union steamboats. Smith conceived a plan for opening the road from Kelley's Ferry to Chattanooga

which called for an amphibious assault on the Confederate-held bank of the Tennessee at Brown's Ferry. General George H. Thomas and General Ulysses S. Grant approved this plan and General Smith ordered the First Michigan Engineers to prepare two flatboats and fifty pontons to use as landing craft for the assault and subsequently as a bridge across the Tennessee at Brown's Ferry.[20]

During the night of October 26-27, 1863, the First Michigan Engineers, in charge of chess planks and floating bridge equipage, and a portion of the assault force concealed themselves on the north bank of the Tennessee near the point selected for the assault. The remainder of the assault force, 1500 men, embarked in pontons from Chattanooga at three in the morning and floated under cover of darkness down river around Moccasin Bend to Brown's Ferry, where a landing was effected and a beachhead established. The First Michigan Engineers, under Confederate artillery fire, laid a 900-foot ponton bridge across the Tennessee to cross more troops. This force, together with a Union army advancing up the valley from Bridgeport, Alabama, secured the south bank of the Tennessee, thus opening the river to traffic. Supply transports, constructed by the Engineers and the Quartermaster Department at Bridgeport and Chattanooga, brought rations into Chattanooga and the Confederate siege was broken.[21]

A month later, a Union army commanded by General Ambrose Burnside was besieged at Knoxville, Tennessee, by a Confederate army under General James Longstreet. Captain Orlando M. Poe, Corps of Engineers, and an Engineer battalion selected the Union positions in Knoxville, directed the construction of fortifications and intrenchments, and prepared the city for defense. Barbed wire was not used during the Civil War, but the first use of wire entanglements in combat was made by Captain Orlando M. Poe at Knoxville when he strung telegraph wire from the stumps of trees in front of the Union defensive positions.[22]

Before the Knoxville campaign, General James Longstreet had requested proper maps and the services of Engineer officers but had received neither; hence, the Confederate army was unprepared for a proper siege. The failure of the Confederate siege of Knoxville was due in part to the lack of adequate maps, for the Confederate command believed the French Broad River joined the Holston River below Knoxville, not above it. Therefore, the French Broad was left open to navigation and critical supplies flowed into the beleaguered Union army every night. It was reported the Union army had more provisions in the city at the end of the siege than before it began.[23]

The major Confederate assault on Knoxville was made on the morning of November 29, 1863, and it was a disaster. The Confederate assault column floundered on the abatis and telegraph wire emplaced by Union Engineers. It attacked the strongest position in the Union line, and it was destroyed in an eight-feet-deep ditch below Fort Sanders. General Longstreet believed the attack was directed at the weakest point of the Union line, whereas it was the strongest; he thought the ditch before the fort was shallow because he had observed Union soldiers crossing it, but actually they were walking on boards rather than in the ditch. These faulty observations created the erroneous impression that scaling ladders were not necessary for the assault, a neglect for which General Lafayette McLaws, the officer in immediate command of the assault, was court-martialed. General Longstreet was asked at the court-martial: "Did you furnish the accused [McLaws] with any officer of engineers or of artillery to assist him in preparing his attack, or of obtaining information by reconnaissance or otherwise to the same end?" General Longstreet could only reply: "I did not. I furnished him with no officer of engineers; I had none to use myself for that service." General McLaws was acquitted of the charges.[24]

The last major siege in the Cumberland and Tennessee valleys occurred at Nashville in November-December, 1864, when a Confederate army commanded by General John B. Hood besieged a Union army under General George H.

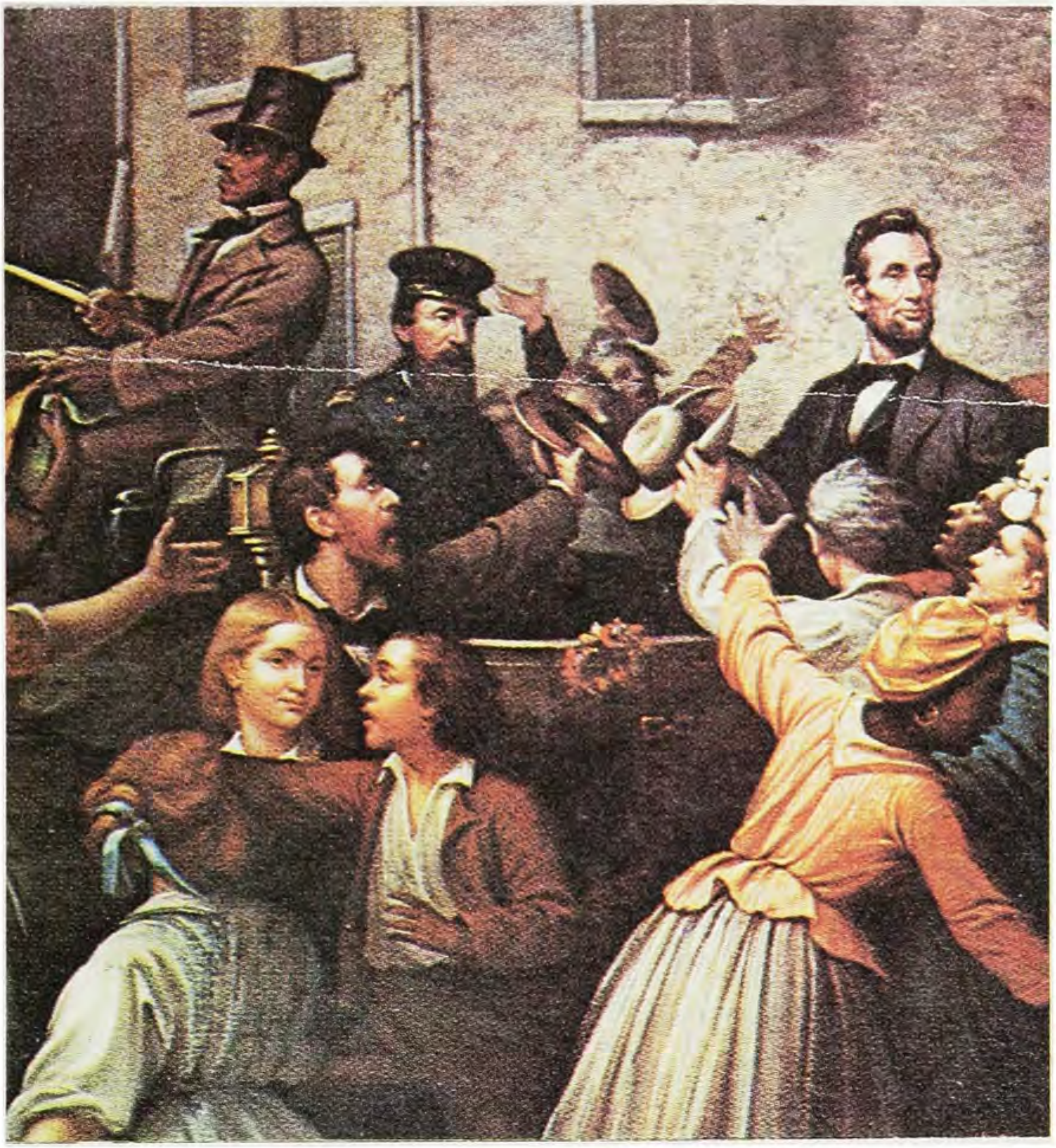
General Zealous B. Tower fortified Nashville in November 1864.

Major Wilbur Fisk Foster, Confederate Army Engineer, 1861-1865.

Thomas within the city of Nashville. The fortification of Nashville by Union Army Engineers had begun in August, 1862, when the main body of the Union army had returned to Kentucky in pursuit of General Braxton Bragg and General Edmund Kirby Smith. Captain James St. Clair Morton, Corps of Engineers, was directed to prepare the city for defense against any contingency, and, to accomplish the mission quickly, he siezed tools, wagons, carriages, and the entire black male population of the city to initiate construction of a ring of forts on the hills surrounding the city—Fort Negley, Fort Andrew Johnson (Capitol Hill), Fort Confiscation, Fort Casino, and later Fort Houston and Fort Morton. These fortifications enabled a Union garrison to hold the city against a short siege in early November, 1862.[25]

Union Engineers continued the construction of fortifications around Nashville throughout 1863 and 1864, expending $365,875 upon the works. An investigator from the Office of the Chief of Engineers in Washington inspected operations at Nashville in early 1864 and reported there was much extravagant waste of money by the Engineers at Nashville on useless fortifications. General Zealous B. Tower, Superintendent of West Point, was then ordered to Nashville with the special rank of Inspector-General of Fortifications to economize operations and investigate alleged waste, but by the time he arrived in Nashville the "extravagance" was about to prove beneficial. General Tower found the lines of defense laid out by Captain Morton in 1862 were still the best available, and, as a Confederate army began to move north toward Tennessee, Tower suggested that these lines be strengthened to give additional security to Nashville, "so important," he said, "as the great depot of the West."[26]

The commanding general gave General Tower wide authority, and all the men who could be spared, to rush completion of the fortifications when it became evident that General John B.



General Godfrey Weitzel, Union Army Engineer, discusses postwar recovery with President Lincoln. 1865.
Chicago Historical Society.

Hood and the Confederate army were on their way to Nashville. The Office of the Chief of Engineers ordered another officer to Nashville to aid in the emergency, and on November 13, 1864, Captain John W. Barlow, who later became the first Nashville District Engineer, arrived at the capital city and took immediate charge of the defenses of the city under the general direction of General Tower. General Tower suggested to General Thomas that the men of the Quartermaster Department in Nashville be thrown into the lines, and, this being approved, he and Captain Barlow laid out an interior defensive line. During the month preceding the Battle of Nashville, more than seven miles of infantry parapet and trenches were laid out and constructed.[27]

General John B. Hood, commanding the Confederate forces around Nashville, said he was "well aware of our inability to attack the Federals in their new stronghold with any hope of success. . . . " He chose to intrench around the city, hope for reinforcements, and wait for General

Thomas and the Union army to come out of the fortifications and fight. Hence, the work of the Union Engineers at Nashville reaped rewards in 1864, for the elaborate fortifications surrounding the "great depot of the West" enabled General Thomas to concentrate his army, some say to double the number of effectives by reinforcement, and to hold the Confederates out of the city until he was prepared to challenge them. On December 15-16, 1864, the Union army left the protection of the Engineer fortifications and flanked General Hood's army, destroying it as an effective combat organization.[28]

Without deprecating the contributions of the other arms of the service, it may be observed that the Union army gained its most notable successes where the Engineers played their greatest role. Perhaps it is more than mere coincidence that the Union army never abandoned a major siege once begun, nor surrendered a position regularly invested and besieged; that is, the Union armies were successful where engineering operations were paramount. On the other hand, Confederates armies, suffering from a grave shortage of trained military engineers, never carried an important fortress-city by regular investment and were compelled to surrender all fortresses in which they were besieged, though fighting with valiant tenacity to defend them.

After the Battle of Nashville, the war in the twin valleys was essentially over. Remnants of the Confederate Army of Tennessee escaped pursuing Union cavalry after the disaster at Nashville by crossing a ponton bridge Confederate Engineers had emplaced at Bainbridge Ferry between Big and Little Muscle Shoals on the Tennessee River; a shrewd location which prevented Union gunboats from destroying the bridge. Major Wilbur F. Foster, Confederate Engineers, defended the bridge until the last soldier had crossed and then destroyed it. Sporadic skirmishing continued in the twin valleys in 1865, but the fate of the Confederacy rested, after the Battle of Nashville, on events in Virginia, where an Engineers' war of trenches, redoubts, fortifications, and mining, similar to combat that would ensue during the First World War, was in progress.[29]

In April, 1865, General Robert E. Lee was finally forced out of his defensive position around Richmond, and the escape of the Confederate government from the capital city was arranged by Major General Jeremy Gilmer and Major Wilbur F. Foster of the Confederate Engineers. The first troops to enter Richmond were commanded by General Godfrey Weitzel and his Engineer officer, Major William R. King. Both were to take charge of the improvement of the Cumberland and Tennessee rivers in the postwar era. Major King and his Engineer troops put out the fires in Richmond and General Godfrey Weitzel met President Abraham Lincoln in the charred city. General Weitzel and the President toured the home of Jefferson Davis and Libby Prison, and during the tour General Weitzel asked the President what ought to be done about the citizens of Richmond. Lincoln replied that he did not wish to give any orders on the subject, but if "I were in your place I'd let 'em up easy, let 'em up easy." The philosophy implied in these words was to motivate in part the projects for the improvement of the Tennessee and Cumberland rivers which were adopted shortly after the war, under the direction of General Weitzel.[30]

In 1865 the Army Engineers laid down their arms—the military mission was over. Union Engineer officers returned to peacetime duty on civil works projects, and Confederate Engineers returned to their war-torn homes to do their part in rebuilding the devastated Southland. Major Wilbur F. Foster and the Foster and Creighton Company, for example, eventually constructed projects for the Nashville District, Corps of Engineers, as a contractor, and other Confederate Engineers were, after a lapse of a few years, reemployed by the Corps of Engineers, United States Army.

CHAPTER VI

REGULATION OF THE TWIN RIVERS

The most sanguinary war in American history drew to its close in 1865, leaving the people of the Cumberland and Tennessee valleys exhausted and the banks of the two rivers lined with symmetrical rows of earthen mounds at Donelson, Shiloh, Nashville, Chattanooga, Knoxville, and a hundred other sites as grim reminders of the price the nation paid in blood for the control of the twin rivers in the heartland of America. The green and fertile valleys had been devastated time and again by the hungry and angry armies in both blue and gray, the financial and labor systems had been disrupted, and intrastate sectionalism, always a detriment to responsible government in Kentucky and Tennessee, had been heightened. The issues of the war had broken families, and brothers had faced each other on crimson fields of battle.

But despite the animosities aroused by fratricidal war, demobilization was surprisingly swift. The Secretary of War reported over a million volunteer troops had been mustered out of the Union Army by May 1, 1866, and two months later the Quartermaster Department reported its fleet of river transports had been decommissioned and sold (many remained on the twin rivers in peacetime trade). The shell-battered western river fleet—the "Mississippi Squadron"—was transferred from the Navy Department to the War Department in order that the Corps of Engineers might put it to constructive use as snagboats to clear the five-year accumulation of debris clogging the channels of commerce.[1]

The improvement of the nation's rivers and harbors had been practically suspended during the war (the Engineer Department issued no annual reports for 1862 and 1863), but one administrative problem had been solved during the war by the merger of the two Engineer Corps, thus ending the separate history of the Corps of Topographical Engineers. In addition, the Civil War constituted an unappealable decision on the question of internal improvements: their constitutionality was no longer seriously questioned. The eclipse of the states' rights segment of the Democratic party and the ascendancy of the Republican party, which strongly advocated a national program of internal improvements-civil works, opened the way for a vigorous and sometimes constructive policy of waterways development.[2]

After 1866 the United States was fully committed to the improvement of its navigable waterways, and even initiated some efforts at flood control as early as 1879 through a levee system on the Mississippi River. But for the most part the rivers of America were developed for the single purpose of navigation—no coordinated, comprehensive plan for water resource development for multiple purposes being established until the third decade of the twentieth century. And until the latter was accomplished Congress provided for the improvement of the nation's waterways by separate, disconnected, and occasionally haphazard projects and appropriations.

The Rivers and Harbors Act of 1866 marked a sweeping revision in the civil works policy of the national government. It provided large appropriations for rivers and harbors, directed the Engineer Department to resurvey all prewar projects, and directed that an estimate be made of the amount of commerce and navigation

which would be benefited by projects, the first legal requirement that benefits of a project be compared with its costs.[3]

In accordance with the instructions of the act, Chief of Engineers Richard Delafield, the officer who had executed the first survey of the Cumberland River in 1832, reported a few projects completed before the war had resulted in great benefits, but "in others no advantages have been obtained; that the whole system was for several years abandoned and allowed to go to decay; that in few instances has any *permanent* benefit been secured; that annual expenditure is indispensable to obtain the desired object. . . ."[4]

As the Chief explained, the work of improving the nation's waterways was actually beginning anew in 1866. The Rivers and Harbors Act of that year did not provide funds for the renewal of operations on many major rivers, among them the Cumberland and Tennessee, but the omission of the twin rivers was to be remedied before the end of the decade, necessitated by the swift revival of commerce on the two waterways.

Perhaps the most important reason for the swift renewal of commerce on the Tennessee was the postwar growth of the iron industry in the valley, due in part to the discovery of the "dye stone belt" of iron ore by a Union officer, John T. Wilder of the "Lightning Brigade," during the war. General Wilder owned several iron works in the Hanging Rock region along the Ohio River before the war, and during his campaign with the Army of the Cumberland he discovered

Steamboats moved materials to the iron furnaces and rolling mills on the twin rivers.

the industrial potentialities of East Tennessee. He purchased rolling mills built by the Engineer Department at Chattanooga during the war, organized the Roane Iron Company, laid out the town of Rockwood, and erected a blast furnace, the first to use coke in the South.[5]

General Wilder was just one of many Union officers who remained in the South after the war—indeed, they became just as common in Southern industry as Confederate officers did in Congress—to develop the untapped resources and markets of the South. Wilder's iron company soon had competitors throughout the Tennessee Valley, such as the Dayton Coal and Iron Company, the Durham Coal Company, and the Southern States Coal, Iron and Land Company, to mention a few, and as early as 1870 Chattanoogans were referring to their city as the "Pittsburgh of the South." By 1885 there were nine furnaces and seventeen foundries and machine shops in Chattanooga alone, while down river the iron industry around the town of Sheffield, Alabama (founded in 1884), was beginning to flourish. The South produced more iron in 1886 than had the entire nation in any one year prior to the Civil War, and much of this production was in the Tennessee Valley.[6]

One of the reasons for the location of this thriving new industry on the banks of the Tennessee River was the economical transportation which the waterway provided. General Wilder's company, for example, utilized the Tennessee to transport iron from its furnace at Rockwood to the rolling mill at Chattanooga. Statistics compiled by the Engineer Department for commerce on the Upper Tennessee River during fiscal year 1879 indicate the significance of the iron industry to renewed traffic on the river:

Pig iron	tons	8,951.71
Iron-ore	tons	4,574.71
Limestone	tons	6,300
Coal	bushels	625,000
Grain	bushels	413,000
Hay	bales	742
Flour	barrels	2,162
Bacon	pounds	45,000.7

It was estimated, in addition to the above listed commodities, that up to five million board-feet of saw logs were floated down to Chattanooga, plus large quantities of sand, cornmeal, dried fruit, peas, cattle, and lumber. About 125 flatboats crammed to the gunwales with produce descended the Clinch, Holston, Powell's, French Broad, and Tennessee River to Chattanooga, and steamboats landed there about 200 times during 1879.[8]

It is therefore not surprising that improvement of navigation on the Tennessee River received such great and broadly-based support in the postwar era. Citizens of Chattanooga resolved in mass meeting in 1867 that improvement of the Tennessee River from Chattanooga through the Muscle Shoals to open through-navigation to the mouth of the river was vital to the people of Tennessee and Alabama; and a convention of 143 delegates assembled in Chattanooga in 1868 to urge upon the United States the importance of improvement of the Tennessee to the national welfare. The convention proclaimed the vast natural resources of the Tennessee Valley could be developed only if the river were opened to through-navigation, and, since "the United States is alone authorized to open this river," speedy action by Congress was imperative.[9]

A Tennessee River Improvement Committee was organized and an officer who had commanded volunteer Engineer regiments during the war, Colonel Timothy R. Stanley, was appointed as its chairman. (Colonel Stanley had commanded the ponton flotilla which transported Union assault troops down the Tennessee from Chattanooga to Brown's Ferry in October, 1863.) When the Rivers and Harbors Bill was before Congress in 1868, the Tennessee River Improvement Committee urgently pressed for an appropriation for the improvement of the Tennessee in order that the agricultural and mercantile interests of the valley might be enhanced and to "furnish employment to thousands."[10]

These expressions of public support for the improvement of the Tennessee were merely the first of many, for they were followed by conventions in 1877 at Chattanooga, in 1880 at Huntsville, again at Chattanooga in 1884, and at Knoxville in 1889 which supported projects on the

Log rafts at Nashville during a Cumberland River flood. *Jack Custer Photo Collection*

Tennessee. The Tennessee River Improvement Association was active for many years and was one of the most effective waterway organizations in the nation, providing strong support for the improvement of a most recalcitrant river.[11]

By coincidence, 1867, the year the United States initiated the postwar improvement of the Tennessee, was also the year of the greatest flood to inundate the Tennessee Valley prior to 1973. The winter of 1866-67 was bitterly cold and marked by an exceptionally heavy snowfall. The accumulation began to thaw in late February, not an extraordinary occurrence, but heavy rains also began in the Upper Tennessee Valley on March 2, quickly swelling the river to record heights. Soon a flood was washing bridges, buildings, and all else in its path in the direction of Paducah, with furniture, cattle, trees, and other debris spinning on its crest.[12]

A hundred people were washed out of their homes at Knoxville where the river crested at 48 feet above the low-water mark on March 8. That night the floodwave hit Chattanooga without warning, forcing sleepy residents from their beds to their roofs as most of the town was submerged by the record crest of 58.6 feet. The flood reached a height of near seventy feet in the Suck below Chattanooga, washed away the railroad bridge at Bridgeport, Alabama, and would have destroyed the bridge at Decatur, had it not been raised forty inches with jack-screws. The Bridgeport bridge, with the frightened watchmen still aboard, was found 75 miles downriver. Kingsport, Knoxville, Chattanooga,

Decatur, Florence, Paducah and all villages along the river were heavily damaged. Charleston on the Hiwassee River and Johnsonville on the Tennessee were entirely submerged. Thousands of acres were denuded of soil or covered with silt, and, because the rise was so swift, many lives were lost. Damages in East Tennessee were estimated at $2,000,000, a truly huge sum in 1867 dollars.[13]

Control of such calamitous floods did not, however, become a major mission of the Army Engineers until the twentieth century, and the flood of 1867 did not figure in the authorization of a project for the improvement of the Tennessee. The United States was concerned primarily with the improvement of navigation for the benefit of the increasing volume of traffic on the Tennessee, and it was to that end that Congress directed a survey of the Tennessee River from Chattanooga to Paducah in 1867.[14]

Major General Godfrey Weitzel, charged with performance of the survey of the Tennessee, was a bearded, battle-scarred veteran who had won brevets six times during the Civil War. He graduated from West Point in 1855, served on fortification construction until 1861, and during the course of the war gained combat experience at Fort Pickens, Florida, the siege of Port Hudson on the Mississippi, and in the action around Richmond late in the war. After Appomattox, he went with troops to the Rio Grande to serve notice of eviction on the French in Mexico, then returned to duty with the Corps of Engineers, and was stationed at Louisville, Kentucky, to supervise operations around the Falls of the Ohio; and the survey of the Tennessee, a tributary of the Ohio, became his responsibility.[15]

On the recommendation of several East Tennessee congressmen, General Weitzel appointed Colonel William B. Gaw, a Union officer who chose Chattanooga as his postwar home, to the position of Superintendent of the Tennessee River Improvement at the munificent salary of eight dollars per day, plus

The wooden bridge, complete with draw span, built by Union Army Engineers at Chattanooga in 1865 was destroyed by the record flood of 1867.

General Godfrey Weitzel directed the surveys of the Tennessee and Cumberland Rivers in 1867 and 1871.
Cincinnati Historical Society

the expenses of a small office furnished "in a cheap and simple manner."[16]

Colonel Gaw had been brought into the Union Army as a topographical engineer by his friend and schoolmate, Major General James B. McPherson. He had distinguished himself as an Engineer under the command of General George H. Thomas and Captain William E. Merrill in the Army of the Cumberland, and near the end of the war accepted the command of the Sixteenth United States Infantry (Colored).[17]

The Colonel settled in Chattanooga after the war and engaged in civil engineering for railroads until appointed Superintendent of the Tennessee River Improvement. After organizing an Engineer party in late summer, 1867, Colonel Gaw departed Chattanooga on September 18 on a covered barge, accompanied by a dozen men, to float to Paducah, making the survey as the party descended.[18]

The survey party was quickly debilitated by malaria and other diseases; then on October 7 the rampant Tennessee claimed another life from the Engineer Department. Edward McDermott, topographer, and W. P Holman, leveler, were running through the Suck below Chattanooga, not far from where an assistant engineer of Colonel Stephen Long's party lost his life in 1832, when their skiff overturned, spilling the men into the swirling river. Holman attempted to save McDermott, but the topographer was beyond all human help, and the survey was interrupted while his body was returned to Chattanooga. Holman was rewarded for his efforts with a bout of fever, but the remainder of the party returned to the survey, arriving at Paducah on December 20.[19]

Colonel Gaw's report of the survey was favorable to the improvement of the Tennessee; indeed, he was quite enthusiastic about what he had observed:

> From Brown's Ferry a majestic river, broad, deep, and with gentle current at all times, is seen stretching for a hundred miles above through a valley abounding in the latent elements of prosperity; a river which in this distance is seldom seen to bear on its bosom a pellicle of ice, and a country whose climate is so genial that wheat is ripe for harvest by the time green blades in the northwestern States emerge from the snow. Yet, with this favorable combination of natural resources, the valley languishes for want of a cheap transportation to market, and this portion of the river for purposes of constant and certain navigation, is as sealed as though the river had no outlet to the Mississippi valley. Such are the effects, not the magnitude, of the obstruction in Chattanooga mountains and at Muscle Shoals.[20]

Colonel Gaw added comment on the social significance of the proposed project for the improvement of the Tennessee, observing that in "whatever light the opening of the Tennessee River is viewed, whether as a means of developing the material prosperity of the valley or as a means of strengthening the bond of union between north and south by promoting intercourse between them, the subject is one of great moment. . . ."[21]

General Weitzel warmly concurred with the Colonel's assessment of the Tennessee River Project. The project, said the General, "would be a means of giving a poverty-stricken community an opportunity to recover from the disastrous effects of a war, and give employment to a large class of deserving people who are said to be out of employment." The inherent social benefits of the Tennessee River Project—revitalizing a devastated economy, providing employment, and strengthening the bonds of union through commerce—were apparently the primary justification for the project. No methodical comparison of benefits to navigation with costs of construction was made; the enormous untapped natural resources of the Tennessee Valley which a navigable waterway would open to development amply justified the project, in the opinions of Colonel Gaw and General Weitzel.[22]

General Weitzel, impressed by the military value of the project declared he was "perfectly confident that if the distinguished soldiers who commanded our armies operating along the line of this river, during the late war, would be called upon to testify in this matter, that it would be found that enough money would have been saved to the quartermaster's department by an improved river, in one campaign to have trebly paid the expense of doing the work."[23]

Following the Gaw-Weitzel report on the Tennessee, an appropriation for the open-channel improvement of the river was made in 1868, and Colonel Gaw supervised the project from a suboffice at Chattanooga. Since the appropriation was small ($85,000), the Colonel recommended it be expended on the mountain section below Chattanooga, the Suck, where he had lost his topographer. He explained that improving the Suck would give the endeavors of the Engineer Department prestige and assure the completion of the entire river regulation project from Chattanooga to Paducah.[24]

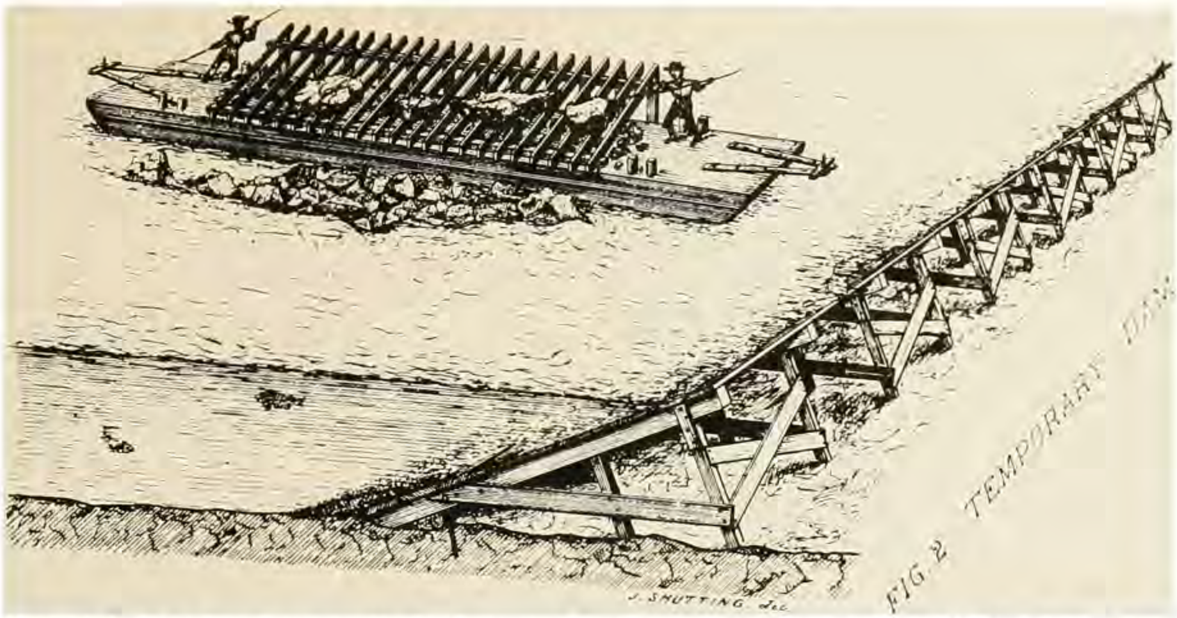
Contracts for the open-channel work were let to the lowest bidders and the improvement of the Suck was prosecuted with celerity under Colonel Gaw's supervision, but the bitter politics of Reconstruction soon deprived him of his position. Radical Republican politicos of East Tennessee complained to the Secretary of War in 1870 that Colonel Gaw was a "Copperhead," prejudiced against the freedmen. General Weitzel rebutted these allegations vigorously, asserting that political affairs were carried on "in Tennessee and in Chattanooga especially, with so much vindictiveness and personal hatred, that I believe in many cases the judgement of the best men down there are warped, especially when there is 'an axe to be ground.'" The General pointed out the only commander of a corps of colored troops during the war had been himself and that Colonel Gaw had likewise commanded freedmen.[25]

But General Weitzel's defense of the Colonel was unavailing, for the Radical Republicans found sympathetic ears in Washington and the Colonel was removed. The crux of the matter was revealed in a letter from an East Tennesseean to a congressman recommending a man for the job whose political views were right: "I hope you will push it through. By doing so, will get shet of a Copperhead and in his place a good Radical provided my friend . . . should get the appointment." General Weitzel frustrated such designs, however, by sending his assistant, Lieutenant Milton B. Adams, Corps of Engineers, to take charge of the Chattanooga suboffice.[26]

Shortly after the postwar improvement of the Tennessee River was initiated, General Weitzel was ordered to prepare a survey of its northern twin, the Cumberland River, "from its mouth to the head of navigation." The Nashville *Republican Banner* was pleased to learn General Weitzel was charged with the survey, and commented it was a "well and painfully recognized fact that large quantities of coal, lumber, grain and other products are lost every year on their way down the river in consequence of obstructions that might easily be removed. It might be supposed that appropriations from time to time would be made for the benefit of this river, but not a dollar has been thus expended by the National Government since 1838, and yet this little river of ours is one of the most important. . . ."[27]

In the antebellum era, cotton had been the principal cargo on the Cumberland, with tobacco second in importance. Cotton was an easily-handled cash crop which moved all the way to market at New Orleans during the high-water season. But in postwar years agricultural production in the Cumberland Valley diversified and larger quantities of grain and pork began to move down the waterway to market. The largest cotton crop to move to market down the Cumberland before the war was 50,000 bales, with the average annual shipment about half that, and in 1865 the cotton shipment was equal to the prewar average, but it consisted largely of old cotton moving to market. Other traffic on the waterway during that year consisted of 6,000 hogsheads of tobacco, 2,000,000 bushels of corn, 25,000 hogs, 10,000 casks of bacon, and 2500 tierces of lard. By 1871 at least twenty-six steamboats were regularly plying the Cumberland; however, the average cargo capacity of each was only 341 tons.[28]

Tobacco rapidly replaced cotton as the principal cash crop in the Cumberland Valley in the postwar years, with Clarksville, Tennessee, serving as the marketing center. Three thousand hogsheads of tobacco floated down the Red River to the Cumberland at Clarksville in 1880 alone, and the city soon was the second largest tobacco market in the United States. But by 1887 most of the



Temporary dams, as shown, were used by the Engineers to divert current and expose the river bed for blasting, or to create a depth suitable for barging in stone to place in riprap wing dams or dikes.

crop was transported north by railroad instead of the river, perhaps because tobacco moved to market late in the year when the Cumberland River was at its lowest stages.[29]

The Cumberland Valley iron industry had flourished several decades prior to the Civil War—at one time forty-one charcoal furnaces had employed about 3,500 men in the industry—but the war interrupted production and destroyed some of the iron works. Most of the larger works had ceased production by 1873, as the center of the Southern iron industry moved south to the Tennessee Valley and Alabama. The replacement of charcoal-fired by coke furnaces necessitated easy access to coal fields, and, though citizens of Lyon County, Kentucky, on the Lower Cumberland remain proud of the fact that the "air boiling process (Bessemer process)" was invented by William Kelly in Lyon County, the Cumberland iron works are merely memories today. The coal and iron resources of the Upper Cumberland Valley were developed in the postwar era (Middlesboro, Kentucky, was founded in 1889 by an English iron and steel company.); however, the new industry was prevented from using the Cumberland River as an outlet to market because of the interruptions to navigation at Cumberland Falls and Smith's Shoals.[30]

The most important traffic on the Cumberland River above Nashville before 1900 was coal barged down to the capital city from above Burnside, Kentucky. About twelve coal mines were worked in and around Pulaski County, Kentucky, prior to 1880. The Poplar Mountain Coal Company near Rowena was the largest of the mines: it sent 300,000 bushels of coal to market via the river in 1870. Mine operators constructed short rail lines to the banks of the Cumberland, hauled coal out of the mines in six to eight small cars at a time, pulled by mules to the river, and dumped it into wooden barges. Since descent of the river to Nashville was impossible during low-water season, creeks were dammed to provide pools for the loaded coal barges. When a rise occurred in the Cumberland (called a "coal tide" by rivermen), the barges were floated over the dams into the river channel and raced to Nashville on the crest of the "coal tide."[31]

The most hazardous navigational obstruction for the deep-draft coal barges was at Smith's Shoals, a name for four shoals at that point, just above Burnside, Kentucky. The winding, rocky,

Engineer dredges and drill raft constructing riprap dam to concentrate river flow at Big Bend Shoals, Tennessee River, 1913.

and shallow channel at Smith's Shoals ripped the bottom out of many coal barges. During the 1870's, the Army Engineers made an effort to improve the Shoals by open-channel methods: excavating the channel by blasting and constructing wing dams to regulate the flow of the river. But the work was of little benefit, for eighteen barges carrying 100,000 bushels of coal went down at Smith's Shoals in 1878, crippling the industry, and when the "Queen and Crescent" Railroad entered Burnside in 1880 most of the coal traffic switched to the railroad.[32]

In 1871, General Godfrey Weitzel assigned the direction of the survey of the Cumberland River to Sylvanus Thayer Abert, son of John James Abert (Chief of Topographical Engineers, 1838-1861) and named after Sylvanus Thayer, "Father of West Point." S. T. Abert served the Engineer Department in various capacities prior to the Civil War, and after the war he surveyed canal routes across the Central American Isthmus and proposed waterways projects on the Arkansas and Illinois rivers. General Weitzel specifically requested the services of abert on the Cumberland, because Abert had become familiar with the river's navigational problems during the Civil War. (He also designed Fort Garasche in the Nashville system of fortifications and participated in the defense of the city against General Hood's Confederate army in 1864.)[33]

S. T. Abert examined the river from Cumberland Falls to Smithland in 1871 and 1872; his report on the Cumberland becoming the basis for the improvement project on the river until a slackwater,

canalization project was authorized. The Abert-Weitzel report on the Cumberland emphasized the importance of the coal traffic above Nashville and the need for removing the obstacles in the channel which wrecked twelve out of every forty coal barges descending the river. And the report recommended the creation of a three-foot minimum channel at low water to aid the extensive steamboat traffic below the capital city. This depth was to be obtained by channel excavation and clearance, by snag removal, and by the construction of wing dams; that is, the same type of improvement project undertaken by Superintendent William McKnight forty years before.[34]

The Rivers and Harbors Act of 1871 provided only $30,000 to initiate the open-channel regulation of the Cumberland, but it inaugurated the continuous development of the waterway by the Corps of Engineers which has endured for a century. General Godfrey Weitzel determined to expend this first tiny appropriation on the removal of obstructions in the river between Nashville and Harpeth Island, and entered into a contract for the project. The work had an inauspicious beginning, however, because the contractor died shortly after work had begun and the contract was annulled.[35]

Problems with contractors always plagued the Engineer Department in its efforts to improve the twin rivers, and the advantages of the contract system, as opposed to the use of hired labor under the immediate supervision of the Engineers, was a matter of much dispute

Tennessee River at Knoxville before multipurpose development. Note the riprap dikes confining river flow to a well defined channel.

Jack Custer Photo Collection

until modern times. On the Cumberland, as on the Tennessee, an attempt was made after the Civil War to use the contract system exclusively. It failed, as did most of the contractors. There was even a case of a contractor in 1872 who quietly absconded with funds for the improvement of the Tennessee, swindling his workmen and creditors out of their pay. This sort of thing was, to say the least, discouraging to the Engineers. One frank Engineer officer tersely concluded the "contract system has been thoroughly tested on this improvement and proved an utter failure, as I believe it has been and always will be on similar works." Another urged the termination of the contract system on grounds that contractors had to bid high to protect their interests, that the exact measurement of the volume of work involved in channel rectification was impossible, and, since the Federal government was its own insurer, why could it not also do its own work.[36]

The contract system was abandoned on the twin rivers about 1880, with the exception of a few fixed works such as locks and dams. Even in the latter case, where specifications could be firmly established, many contractors failed. As a result, the hired labor system predominated for all channel rectification projects and most permanent installations until the beginning of multipurpose development.[37]

Most tributaries of the Cumberland and Tennessee rivers were first surveyed during the two decades following the Civil War, and the reports of these surveys resembled adventure stories on occasion. Assistant Engineer Maurice Kingsley, for example, made the first survey of the Hiwassee River in 1874 and found time to pan for gold at the base of Chilhowee Mountain. R. C. McCalla executed a dangerous survey of the French Broad River in 1875, commenting laconically in his report that two of his assistants "handled the canoe skillfully and fearlessly through the long and dangerous descent of the rapids, thereby contributing largely to the success of the expedition."[38]

Two typical survey parties were those which examined the Holston River in 1886 and the Upper Tennessee in 1891. The Holston field party consisted of Assistant Engineer Charles A. Locke as chief of party, a raft-pilot, a boatman in a canoe, a rodman and boatman in a second canoe, and a cook and boatman in charge of the camping outfit in a flatboat. The steamboat *Cassandra* had navigated the Holston River up to Kingsport in 1847, and a few other steamers had ascended the stream as far as they were able, but trade on the Holston was largely carried by flatboats coming downriver from as far as Saltville, Virginia, on North Fork of Holston, Bluff City and Elizabethton, Tennessee, on the South Fork and the Watauga rivers, delivering salt, farm produce, and iron products to Knoxville, Chattanooga, and North Alabama. Engineer Charles Locke reported the low stone dams built by the State of Tennessee on the Holston in the 1840's were still functioning, but that a few improvements to benefit the flatboat traffic would be valuable. Congress appropriated a small sum, and the Engineers cleared the Holston River of obstructions from time to time until 1908 when the flatboat commerce was dying.[39]

The Holston party was small in comparison to the group which surveyed the Upper Tennessee in 1891. Captain John Biddle (later Acting Chief of Staff, United States Army, during World War I) headed the 1891 party, which included two Assistant Engineers, three instrument men, nine rodmen, one cook, one cabin boy, and about ten laborers. The party traveled in two quarterboats and a few canoes which were towed up the river by steamboat to float back down as the survey progressed. Besides the distinguished Captain Biddle, the party included some remarkable men who later made a name for themselves in other capacities. One of the rodmen was Benjamin F. Cheatham, son of the Confederate general, who left the Nashville District in 1898 to eventually become Quartermaster General, United States Army, in 1926. One of the assistant engineers was John Lane Van Ornum, who later described the 170,000 soundings he made in nineteen weeks field work during this survey in his book

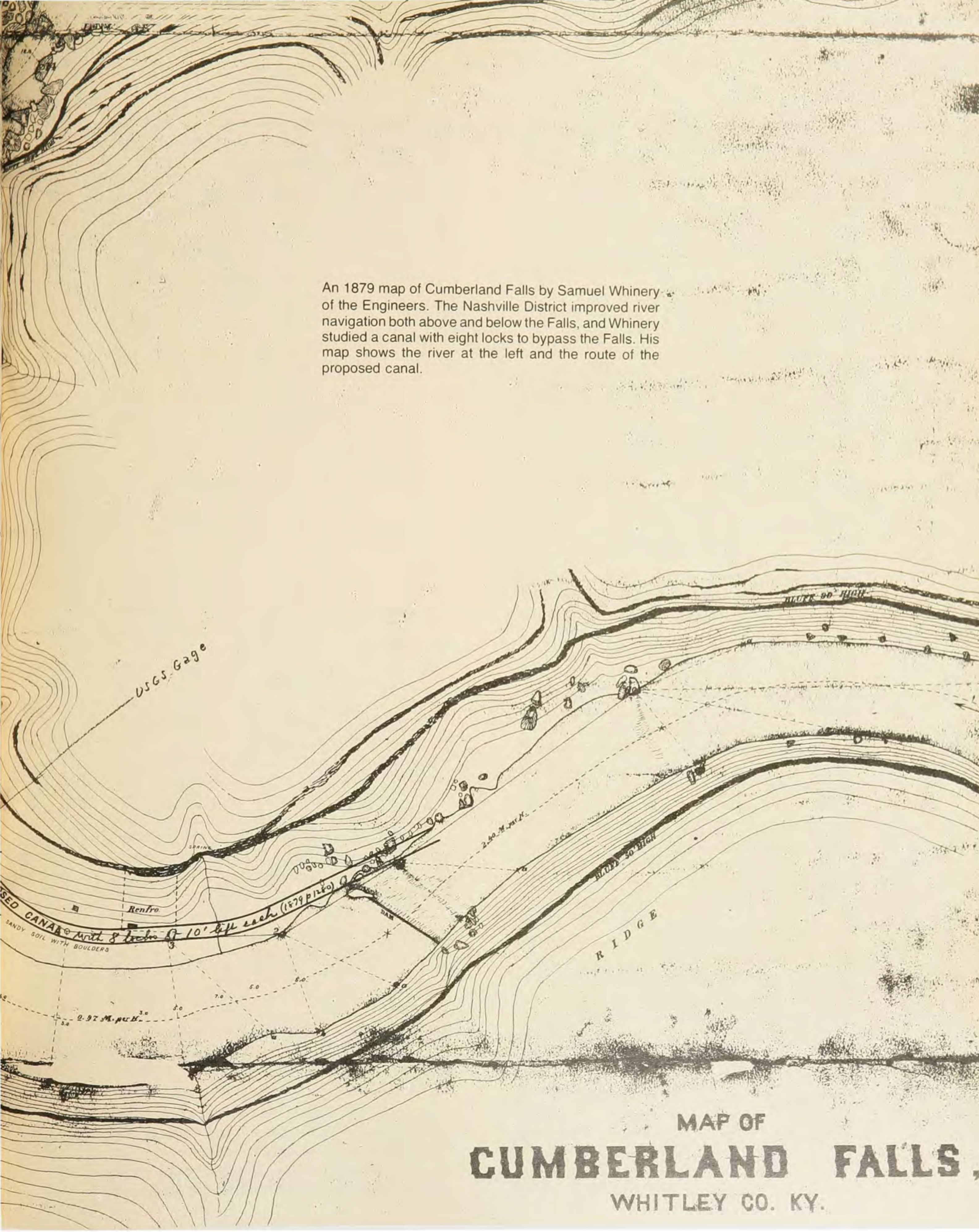
General John Biddle directed an 1893 survey of the Upper Tennessee River. He served as acting Chief of Staff during the First World War.

Regulation of Rivers, which became the text for the Rivers and Harbors Course at the Engineer School (now located at Fort Belvoir, Virginia). Van Ornum became a Major in the Third Regiment, United States Volunteer Engineers, in Cuba in 1898, and after the war he became professor of civil engineering at Washington University of St. Louis, publishing many works on waterways improvement and designing many works for the City of St. Louis and the campus and stadium for the 1904 Olympic games.[40]

Captain Biddle delivered the results of the 1891 field operations to the chief draftsman at the Chattanooga Engineer Office, John A. Ockerson, who spent fourteen months reducing the survey data to 111 maps by hand. During the course of these tedious labors, Ockerson demonstrated the ingenuity which was to characterize his later career by inventing a rolling lettering device to save time. Ockerson became an internationally-recognized authority on waterways development, serving as delegate for the United States at four international congresses on navigation and as a member of the Mississippi River Commission for many years. He was elected president of the American Society of Civil Engineers in 1912, and received the personal commendation of President Taft for his work on the Colorado River. Ockerson, Van Ornum, Cheatham, and Biddle made the party which surveyed the Upper Tennessee in 1891 the most distinguished for talent in the history of Engineer operations on the twin rivers.[41]

In addition to the high adventure recorded in some of the early survey reports, many included pithy comments on the character and social conditions of the people living along the banks of the rivers. After one such survey, the Engineer reported that obstructions to navigation prevented farmers from getting their produce to market, forcing them to engage in illicit distilling for profit. He added that "the expense to the government in putting down this nefarious traffic would go far towards improving the river and making good citizens of those who are now engaged in violating the laws." Perhaps it should be mentioned that moral edification was not a benefit commonly credited to Engineer projects.[42]

Although the Engineers who made these early surveys lived a rough and dangerous life, they were highly-trained professionals, quick to criticize any poorly conceived projects. Lieutenant William L. Marshall (later Chief of Engineers, United States Army) declared sharply in 1880 that his examination of a stream had revealed absolutely no commerce on it and no demand for improvement by the citizens of its watershed,



An 1879 map of Cumberland Falls by Samuel Whinery of the Engineers. The Nashville District improved river navigation both above and below the Falls, and Whinery studied a canal with eight locks to bypass the Falls. His map shows the river at the left and the route of the proposed canal.

except "a general desire to profit by any work whatever in their vicinity, to which they are not called upon directly to contribute. . . ."[43]

Assistant Engineer Samuel Whinery examined the Cumberland Valley above the Falls in 1879 and disapproved of any work on that segment of the river because the land was "very rough and sterile" and the population "made up of the most shiftless class of mountaineers." Needless to say, Whinery's report was not favorably received by the population of the region, or the Engineer Department and a resurvey was made the following year. Whinery probably thought the entire incident amusing in his later years, for he left the Engineer Department to become Superintendent of the New Orleans and Northeastern Railroad, and later he designed an Incline Railroad up Lookout Mountain at Chattanooga. He became a nationally known consulting engineer, and used his reputation to lecture the Engineer Department about its failures on many occasions.[44]

Once a survey was completed, and Congress made an appropriation for a project, the regulation of the rivers began. Except for Muscle Shoals Canal on the Tennessee and the canalization project on the Cumberland (to be treated in subsequent chapters), the projects executed by the Engineers in the twin basins prior to 1900 were all open-channel operations, or river regulation. This consisted of channel rectification by clearing away snags and boulders, blasting a deeper channel through shoals, and constructing wing dams to constrict the water flow enough to scour the bottom of the channel and provide increased depth for low-water navigation.

Some of these regulation projects were carried out in a simple fashion. The Clinch River, tributary of the Tennessee, was first improved by a party which descended the river in seven "bateaux." As the party floated downstream, the men picked up the smaller stones and tossed them out of the channel, removed snags, blasted rock ledges, and cut overhanging trees, losing several boats during the adventure. But the chief of the party asserted the depth of the channel had been increased enough to "enable raftsmen to run the river on at least a foot less water than ever before."[45]

Practically all river regulation was at first accomplished by hand labor during the low-water season, when the men could walk on the bottom of the channel. To excavate rock from the channel, a man stood in the water and held a steel drill firmly while "strikers" stood on a simple raft to operate the power tools—sledgehammers. This operation required a certain amount of confidence in the "strikers" on the part of the man holding the drill. Once the proper depth in the rock had been obtained, dynamite was inserted into the hole and the rock was blasted out.[46]

After the blast the men waded back into the water to shovel small fragments of stone into a boat for removal, loading the larger pieces with a stiff-leg derrick mounted on a barge. As one would imagine, there was a great deal of personal danger involved in such primitive operations and accidents frequently occurred. Perhaps the most serious in the history of the work occurred at Koger's Island on the Tennessee River below Florence in 1914 when charges set in drill holes detonated prematurely; ten men lost their lives and eighteen others were seriously injured.[47]

Because operations were restricted to seasons when the waters were warm and low, early attention was given to the mechanization of operations in order that the working season might be extended and personal hazards lessened. In 1876 a scraper worked by a steamboat was devised by District Engineer William R. King to remove gravel bars at higher and colder water stages. Superintendent R. R. Thacher designed a drilling raft in 1896 to support steam drills and thus eliminate hand drilling; it saved sixty per cent of the cost of performing the labor by hand, was adopted for use on the Tennessee and Cumberland, and soon was in use nationally for this variety of work.[48]

It has probably been noticed that occasionally work on rivers outside the twin river basins has been mentioned; this is because the present watershed administrative organization for Engineer

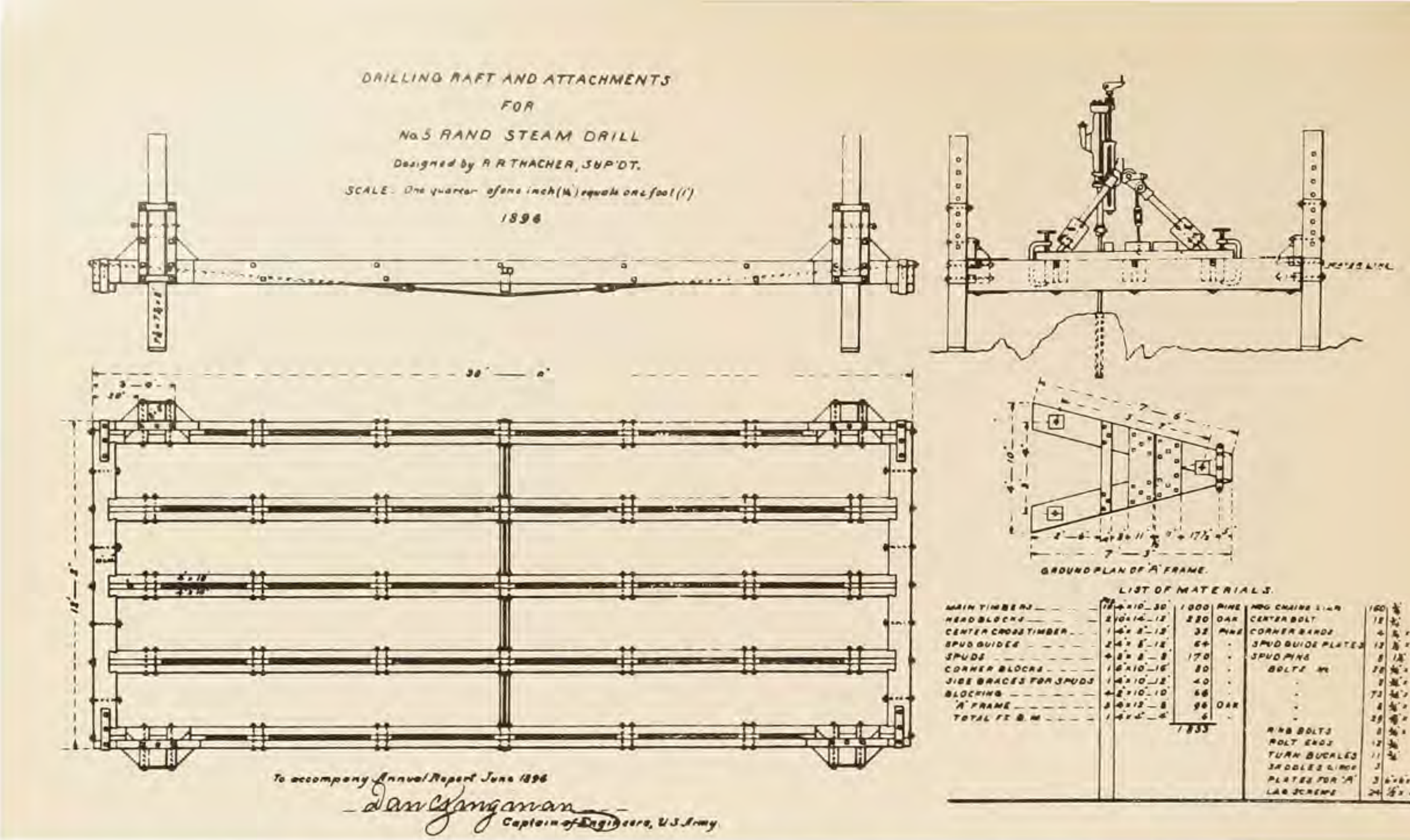
Until about 1890, rock was drilled for blasting by hand.

operations was not adopted until 1888. In 1882 the Chattanooga Engineer Office had charge of the improvement of seventeen rivers: Tennessee, Cumberland, Hiwassee, French Broad, Clinch, Duck, Obey's, Caney Fork, Coosa, Oostenaula, Coosawattee, Ocmulgee, Etowah, Oconee, Red River (of Tennessee-Kentucky), Big South Fork, and the Little Tennessee. In 1885 the rivers in Georgia and Alabama which drain to the south were reassigned to an Engineer Office at Mobile, but shortly thereafter the improvement of the Obion, Forked Deer, and other streams emptying into the Mississippi River was assigned to the Nashville-Chattanooga District, which retained responsibility for their improvement until 1923.[49]

From 1867 to 1888, the Nashville and Chattanooga Engineer offices were known officially as the Office of the Improvement of the Cumberland River and the Office of the Improvement of the Tennessee River respectively. The Engineer officers stationed at Nashville and Chattanooga reported directly to the Office of the Chief of Engineers in Washington until General Order No. 93, November 8, 1888, created an additional administrative layer—the Division—through which all communications were to pass thereafter. The adoption of the "District" designation and the title "District Engineer" apparently was a result of the need to distinguish between districts and divisions.

The improvement of the Tennessee and Cumberland rivers was originally, in 1888, placed in the Southwest Division under the command of Division Engineer Cyrus B. Comstock, who had served as General Grant's chief engineer and aide-de-camp during the Civil War. This decentralized organization, with certain modifications, has endured as the administrative structure of the Corps of Engineers' civil works program since 1888, and the Nashville and Chattanooga districts were at various times in the Gulf, Central, and Upper Mississippi Valley Divisions, until united with the Pittsburgh, Huntington, Louisville, and Cincinnati districts in the Ohio River Division (ORD) in 1933.[50]

What were the results of the open-channel river regulation projects? The work of the Engineer Department during the period when this variety of project predominated has been often criticized, but the answer must be that the projects completed by the Engineers were quite satisfactory in most cases and adequate for the raft, flatboat, and steamboat trade of the time. The criticisms should have been directed at the Congress of the



R. R. Thacker, superintendent of the Tennessee River for the Nashville-Chattanooga Engineer District designed the multiple drill raft in 1896.

United States which, as example, made appropriations for the improvement of eighteen rivers in 1882 on which the Engineers had reported *unfavorably*, and for sixteen others which had not been examined by the Engineers at all. The latter included the Upper French Broad River in North Carolina, which was separated from the lower portions of the river in Tennessee by many miles of rapids. One sarcastic congressman commented that even a catfish could not navigate the French Broad River; nevertheless, the project was funded and the Engineers made an effort to improve the river. The French Broad River flows smoothly atop a mountain plateau from Brevard to Asheville, North Carolina, then drops precipitously through a narrow gorge into Tennessee where it gradually broadens into a stream navigable for small steamboats. Small craft transporting mineral and farm products and log-rafts did navigate the French Broad between Brevard and Asheville, and when the Engineers cleared this river section the steamboat *Mountain Lily* was built to run between Brevard and Asheville. Billed as the "highest steamboat in the world," the *Mountain Lily* made several efforts to run from Brevard to Asheville without success, and the steamboat and navigation improvement project were both abandoned.[51]

Another extraordinary example of haphazard river improvement was the survey of the Bartram River authorized by Congress in 1896. The frustrated Chief of Engineers was forced to report that after "diligent search and inquiry" no such river had been found; hence, it was impracticable to make the examination.[52]

Congress simply ordered too many useless surveys to please constituents and authorized too many projects for the funds available to improve; thus, many projects were begun but seemingly never completed. This "driblet system" of appropriation added thousands to project costs and was a subject of continual complaint from both the Engineers and citizens who desired the improvements. One Engineer officer lamented the small amount of annual appropriations for the improvement of the Tennessee River "caused the work to drag along for more than double the time it ought to have taken, and has added materially to the

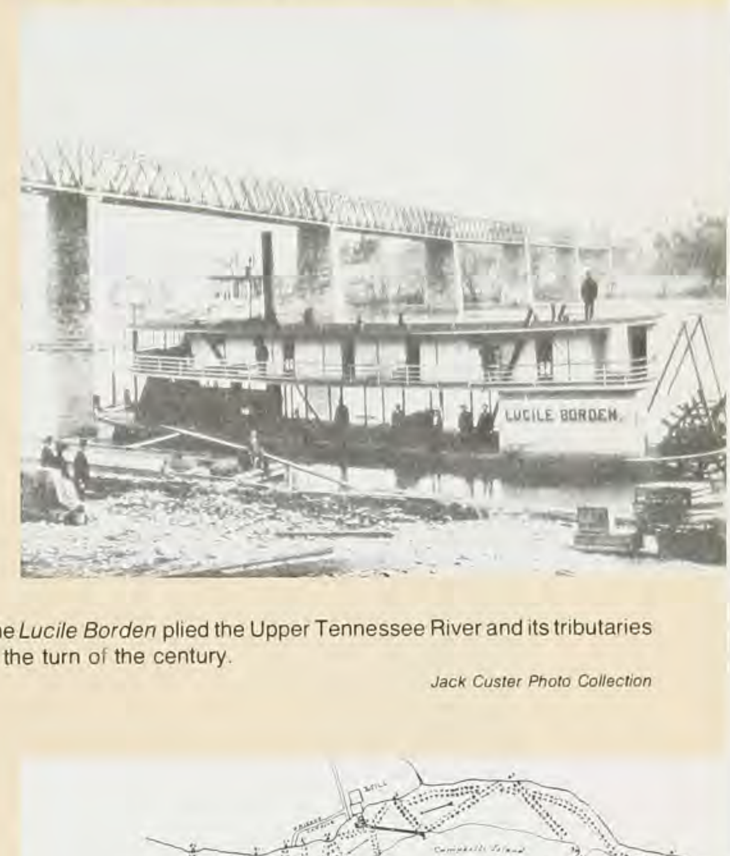
cost." He found the same was true on the Cumberland where boats and tools had to be renewed several times and the costs of engineering and contingencies were far out of proportion to the cost of the work completed.[53]

But in spite of ill-advised projects and meager appropriations, much was accomplished by regulation of the rivers. In 1892 Congress appropriated only $7500 for the improvement of the Obion River in West Tennessee by the Nashville District, but the District cleared the river with that small sum and the steamboat *Fleischauer*, towing two barges of lumber, passed up the river to Obion, Tennessee, in 1893, the first to do so since 1843. A regular trade was inaugurated on the little stream and in 1900 twelve steamboats transported over 67,000 tons of cargo on the Obion.[54]

Though the project on the Upper French Broad River was a dismal failure, the same was not true on its lower reaches. Captain J. E. Newman of the steamboat *Lucille Borden* testified in 1891 the French Broad had been opened from Knoxville to Catlettsburg on Little Pigeon River for almost the entire year by the Engineer Department, and he added: "Before there was any work done on the river by the Government we could not run over 6 months in the year, but . we can run all the time now. . . . The work at Seven Islands, although not completed, has done much good. Before any work was done here by the United States, it usually took a boat from one-half to 1½ days to go through where now we can go through in 45 minutes."[55]

As the end of the nineteenth century approached, river commerce on tributaries of the Cumberland and Tennessee was dying. In 1883, fifty-one rafts and boats were seen on Powell's River in one hour and 181 in one day with over a thousand passengers; but two railroads entered the area in 1891 and river traffic was almost suspended—no more than ten boats per year used the river. This was the story throughout the twin valleys—railroads ended flatboat and raft traffic on the waterways and curtailed steamboat traffic. In 1915, the Nashville District Engineer recommended the old river regulation projects on the trib-

Thacher drill raft in operation at Big Bend Shoals, Tennessee River, about 1910. After holes were drilled in the rock, it was blasted and removed. Note the work force is almost entirely black.



The *Lucile Borden* plied the Upper Tennessee River and its tributaries at the turn of the century.

Jack Custer Photo Collection

Captain John Biddle and his survey party in 1893. Note the hundreds of channel soundings made at each shoal during the survey.

Nashville-Chattanooga Engineer District dredge *Tellico*.

utaries be abandoned, for trade was dwindling and the cost of the work was constantly increasing. After 1923 no further reports were made on these old projects.[56]

The Engineers' improvement of many insignificant streams before the turn of the century may be amusing to the modern reader, accustomed to the great high-dam multipurpose projects of the twentieth century; nevertheless, the value of these old open-channel projects should not be underestimated. Rafting and flatboating down the little streams to the cities on the major rivers constituted an important segment of nineteenth-century waterways commerce. The mountaineer at the headwaters of a stream who loaded his produce—corn, bacon, flour, tobacco, and "white lightning"—into a scow he had constructed himself on the banks of the local "crik" to float down to market at Knoxville, Chattanooga, Nashville, or Clarksville contributed a mighty share to the prosperity of the twin valleys. Each cargo thus moved was perhaps insignificant to the nation as a whole, but to its owner and his family it meant a better life. He and the thousands like him joined together to produce an enormous commercial business in the heartland of America.

CHAPTER VII

CANALS ON THE TENNESSEE

Liberally lacing the fabric which constituted the rationalization behind the revival of interest in the improvement of the nation's waterways after the Civil War was the belief that waterways development would be an effective means of reducing railroad rates and curbing railroad monopolies; hence, the reduction of railroad rates near a waterway became a benefit which could be credited as an effect of a project. *The Annual Report of the Chief of Engineers* listed reductions in railroad charges as an "Effect of Improvement" as late as 1932. In 1935, General Lytle Brown, Chief of Engineers and a native of Franklin, Tennessee, placed the waterways-railways competition in its historic perspective: "The great railroad systems which began to grow by leaps and bounds after the Civil War were not long in stirring up dissatisfaction. They were in private hands and operated for profit. They held the business of the country and its development in their grasp, no doubt. As opposition grew people began to take interest again in water transport. The central government responded by improving channels for navigation, and the amounts of expended money for that purpose have been increasing steadily."[1]

One of the effects of the "dissatisfaction" General Brown described was a renewed interest in canals as a source of competition with railroads, and this interest resulted in a revival of the old dream of a Southern Route.

In 1874 the Senate's Select Committee on Transportation-Routes to the Seaboard, the "Windom Committee," reported cheap transportation could be provided by waterways improvement, that such improvements would also provide competition for and regulation of railroads, and that construction of certain canals routes, among them the Southern Route, would accomplish these desirable results.[2]

Proponents of the Southern Route during the nineteenth century envisioned an elaborate integrated system of canals and improved waterways which would transport the trade of Midwestern and Plains states into the South and from thence to the Gulf and Atlantic coasts for shipment around the world. Plans included a canal to connect the Kentucky River with Cumberland River, another connecting the Cumberland with the Tennessee, a third joining the Tennessee with the Mississippi River, a fourth uniting the Tennessee with the Gulf of Mexico via the rivers of Alabama, and another linking the Tennessee with the Atlantic Ocean via the rivers of Georgia.[3]

The canal linking the Kentucky and Cumberland rivers (from Collins Fork of the Kentucky to Cumberland Ford) was surveyed in 1879 by the Engineers, but was soon forgotten although the survey report was favorable. Engineers of the State of Tennessee surveyed a canal route to join the Tennessee with the Mississippi and another uniting the Cumberland with the Tennessee; the former was never constructed, but a canal between the Cumberland and Tennessee (Barkley Canal) was excavated in modern times and bears a heavy traffic today. The proposed canal to link the Tennessee with the Gulf of Mexico was surveyed in 1875 by U. S. Assistant Engineer Powhatan Robinson who examined a route from the Tennessee to the Tombigbee along the line of Bear Creek. He was highly critical of the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L. ONTARIO
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CONN
R.I.
L. ERIE
PENN.
N.J.
MISS. R.
MD.
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OHIO R.
KANAWHA R.
JAMES R.
KY.
VA.
TENN.
N.C.
TENN R.
S.C.
ALTAMAHA R.
MISS.
ALA.
GA.
FLA.
J.A. CRUTCHFIELD - '78

project and the idea was dropped until revived in the twentieth century in different form—the Tennessee-Tombigbee Waterway.[4]

The union of the Tennessee with the Atlantic coast by an "Atlantic and Great Western Canal" was the project which received the most attention in the period subsequent to the Civil War, and it was carefully studied by the Windom Committee on Transportation in 1874. The project involved improving the Tennessee by canal to bypass Muscle Shoals and excavating another canal to link tributaries of the Tennessee with tributaries of Georgia's rivers which empty into the Atlantic. The Engineers surveyed the route of the Atlantic and Great Western Canal in 1872, planning a waterway from the Mississippi, up the Ohio and Tennessee to Short Creek near Guntersville, Alabama; thence by canal across Sand Mountain to the Coosa River; up the Coosa to Rome, Georgia, and from there up the Etowah and Little Rivers; thence by canal across the Chattahoochee plateau and down the Yellow and Ocmulgee rivers to Macon, Georgia; and finally from Macon down the Altamaha River to the sea.[5]

The Engineer officer at Chattanooga endorsed the scheme in testimony before the Windom Committee, observing the route would be shorter by 300 miles from St. Louis to New York City than the same trip via the Illinois and Michigan Canal, Great Lakes, and the Erie Canal. He declared the social consequences of such a project would justify the costs of construction, because it would have a "stimulating effect" upon the economy of the South—it would have an "influence which commerce, the great peacemaker, would surely exercise in removing from the minds of the citizens of different sections of our common country so brought into contact, the feelings of prejudice which too often prevent them from seeing how much there is in each other that deserves admiration and respect."[6]

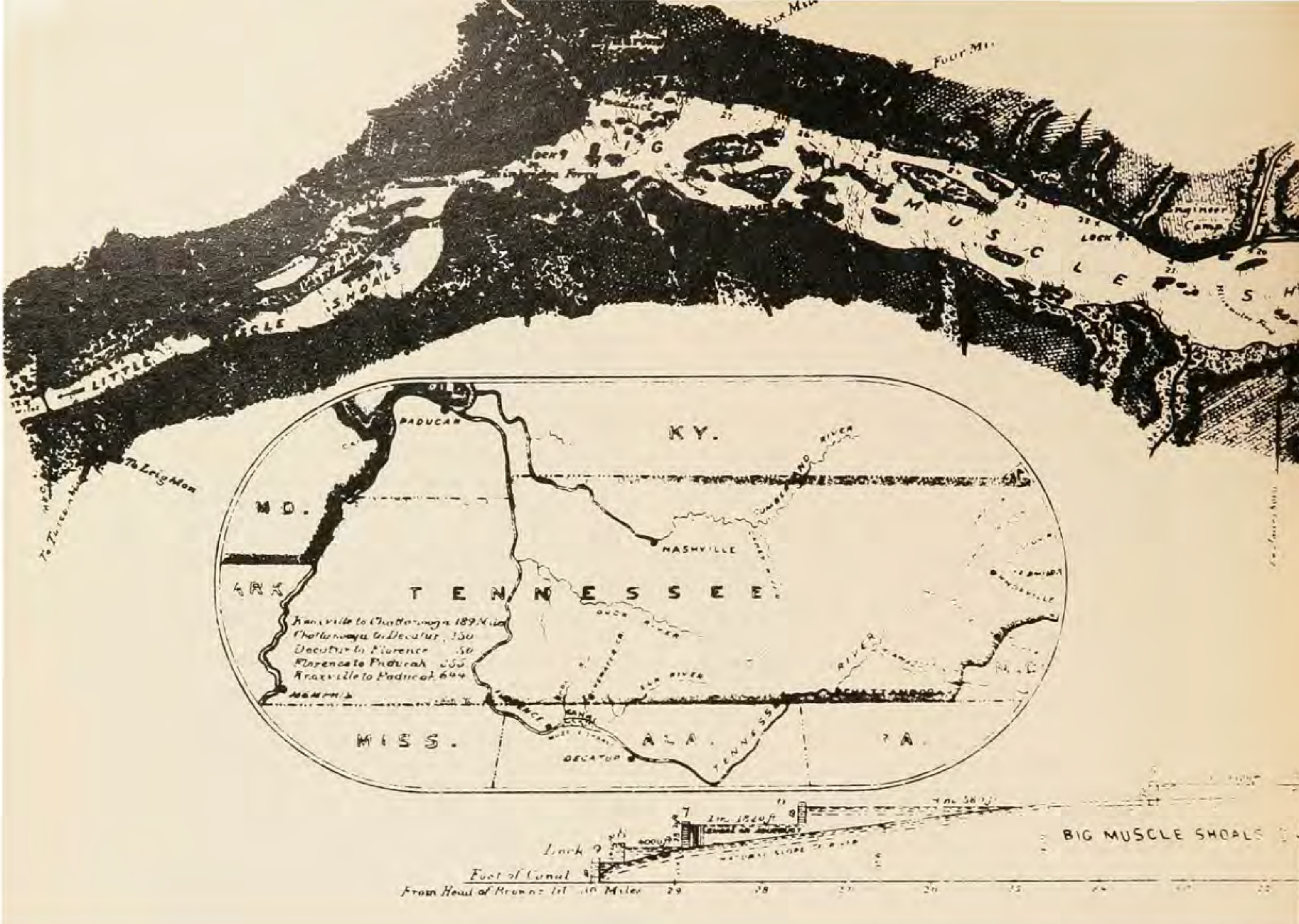
A similar canal line was surveyed in 1880 by U. S. Assistant Engineer Samuel Whinery, who planned a route from the Tennessee up the Hiwassee River and then by canal across Hightower Gap to connect with the Telula River, tributary of the Savannah River. Since it would have been necessary to construct 27 locks to cross Hightower Gap, Whinery suggested blasting a five-mile tunnel through the Gap for the canal. With equal imagination, the Chattanooga Engineer officer suggested the use of inclined planes instead of locks or a tunnel.[7]

None of the proposed canals from the Tennessee to the Atlantic were ever constructed, but the Atlantic and Great Western Canal was endorsed by the Senate Committee on Transportation, because it would open a valuable all-water connection between the grain-growing states of the Midwest and the cotton plantations of the South. The Chattanooga Engineer officer explained to the Committee the canal would be seventy feet wide and five feet deep, that it would move canal boats loaded with grain at St. Louis to the Atlantic coast without transshipment, and that it would *only* require 184 locks and cost merely $35,000,000. This should refute in part the oft-repeated generalization that the Engineer Department is a staid organization, lacking imagination and vision.[8]

It should be added that the scheme was not quite as far-fetched as it seems, for Guntersville, Alabama, where the Atlantic and Great Western Canal was to strike south, became, in the twentieth century, an important grain terminal where Midwestern grains were transferred from barge to railcar for shipment south.

The grandiose Southern Route scheme depended upon the successful circumvention of the great barrier to navigation on the Tennessee at Muscle Shoals. By 1870 the crumbling remains of the old Alabama canal at the Shoals were merely a disintegrating monument

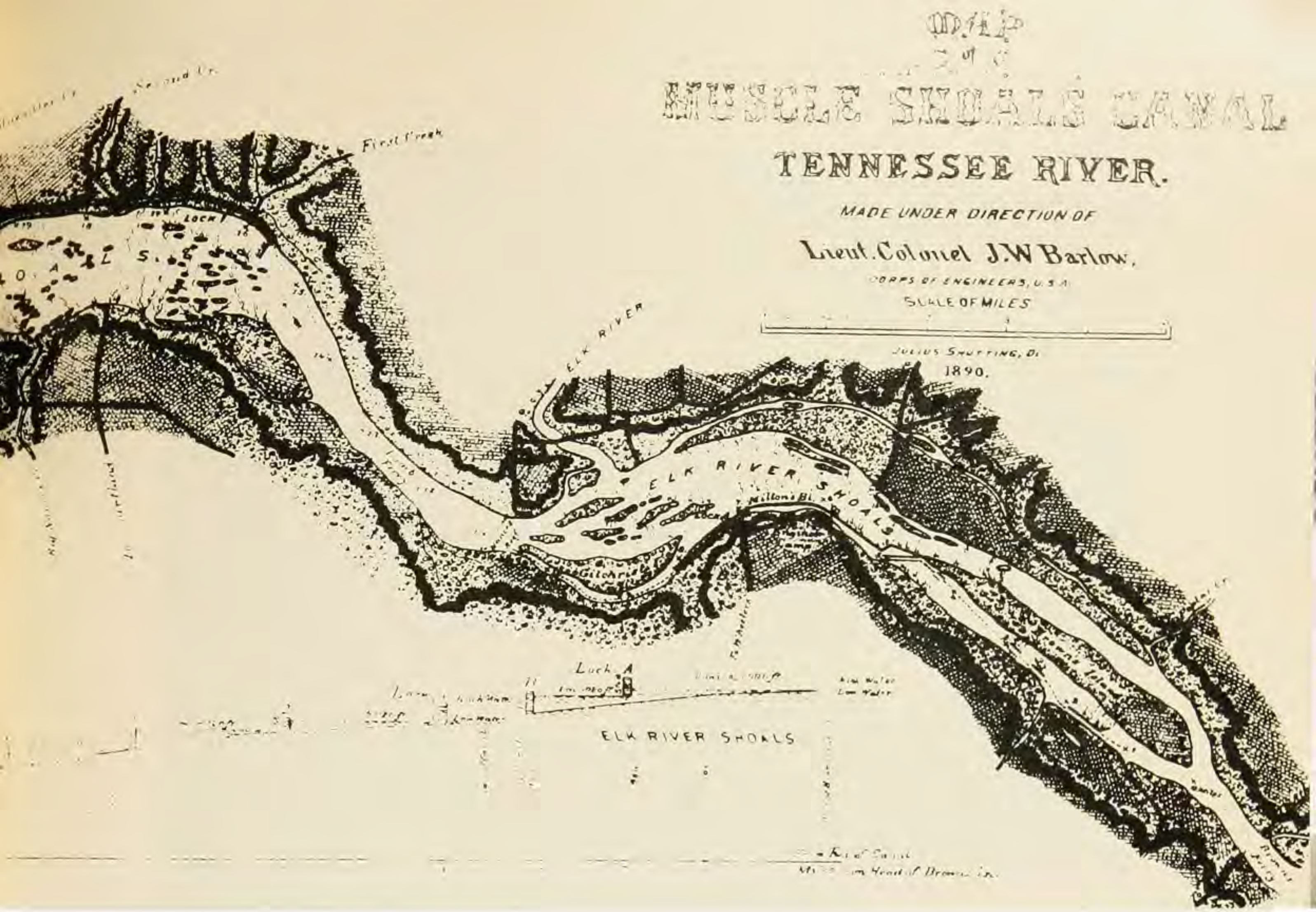
Opposite
Canals to the seaboard proposed by the Windom Committee of the Senate in 1874.



to a bygone age; Muscle Shoals remained impassable except at the highest water stages. But in 1871 the United States took renewed interest in the project and a new survey of the great shoals was ordered.[9]

Major Walter McFarland, Corps of Engineers, assumed the responsibility for the improvement of the Tennessee River from General Godfrey Weitzel at Louisville in 1871. Major McFarland established his headquarters at Chattanooga, thus creating what was to become the Chattanooga District and later the Nashville District, and prepared to carry out the survey of Muscle Shoals. The Major was a grave, austere, and brilliant officer; recognized by his contemporaries as a genius—he graduated first in the Class of 1860 at West Point—but his superb abilities were his undoing. While his classmates, officers like James H. Wilson, Wesley Merritt, and John M. Wilson, were at the front winning battles for the Union and brevet rank for themselves, McFarland was assigned to planning and constructing fortifications and seacoast defenses, projects which, while vital to the Union's war effort, brought no laurels to the young Vauban. Thus it continued after the war; he received some of the toughest assignments the Corps had to offer, and Chattanooga in 1871 was one of them.[10]

Rabid politics had resulted in the removal of Colonel William B. Gaw as Superintendent of the Tennessee River Project in 1870; the contractors employed by General Weitzel were speedily failing; and the dangerous survey of Muscle Shoals was the responsibility of the Chattanooga Engineer Office. The first "Chattanooga District Engineer" organized a party for the survey of the Shoals soon after his arrival at the Mountain City, loading two flatboats with



provisions and employing a band of thirty hardy men for the work. It took the Engineers five days to make the 200 mile trip down to Muscle Shoals, and by the time of arrival the men were infected with malaria—a fourth of them were soon seriously ill. The health hazard was so acute that after the completion of the survey the men were sent north to Painesville, Ohio, to complete the computations and plot the field work.[11]

Major McFarland found the Alabama Canal was so overgrown with vegetation after forty years of neglect that "glimpses only of the fine masonry of its seventeen locks are to be caught here and there through the occasional openings of the dense growth which envelops them." The Major proposed to rebuild and enlarge the old canal and build additional canals around Elk River Shoals and Little Muscle Shoals above and below the old canal, thus constructing three lateral canals, with deep river pools linking them together, on the north bank of the river. There was no comparison of benefits to costs, for the abundant natural resources in the Upper Tennessee Valley, which would be developed if an economical, through water route were available, amply justified the project in the Major's opinion: "The question of opening the Tennessee to navigation has more of a national than of a merely local significance. The only great western river besides the Ohio which reaches the mineral wealth of the Alleghany range, and flowing hundreds of miles along the spurs of that range, through country exceptionally rich in coal, iron, and other minerals, it cannot be doubted that had it not been for . . . Muscle Shoals, a city, the rival of Pittsburg, would have long sprung up in the mountains of Eastern Tennessee. . . ."[12]

But the opening of the Tennessee to

Construction of Lock 4, Muscle Shoals Canal in July 1877.

commerce proved a more formidable task than Major McFarland anticipated. It was perhaps an omen when the Chattanooga Engineer Office burned on January 13, 1874, leaving in its smouldering ashes the detailed plans for the canal at Muscle Shoals which had been seven months in preparation. The Major had leased the home of General John T. Wilder, founder of the Roane Iron Company, to do double service as his own home and as the Engineer Office; hence, the Major awoke at three in the morning to find the Office burning down over his head. The fire department put in an appearance, but did "no good visible to the naked eye," lamented the Major, and the flames quickly engulfed the twenty-year old wooden building. The District Engineer escaped the holocaust, but the engineering instruments and the elaborate plans for Muscle Shoals Canal did not. It was to be merely the first of many mishaps which marred the Muscle Shoals project.[13]

Actual construction at the project site was initiated in 1875 under the contract system, but so many problems resulted that the system was abandoned in 1879 and hired labor was employed to complete the work. The last contractor demonstrated a "manifest disposition to work at the more profitable parts of the contract to the neglect of those not so profitable," declared the District Engineer when he terminated the contract. Nevertheless, on behalf of the contractors, it should be mentioned that construction was often interrupted by floods and workmen were perennially plagued by disease. The Engineers could do little about the health problem, but a rain gauge was established at Chattanooga and arrangements were made to warn the men at the project by telegram of impending floods.[14]

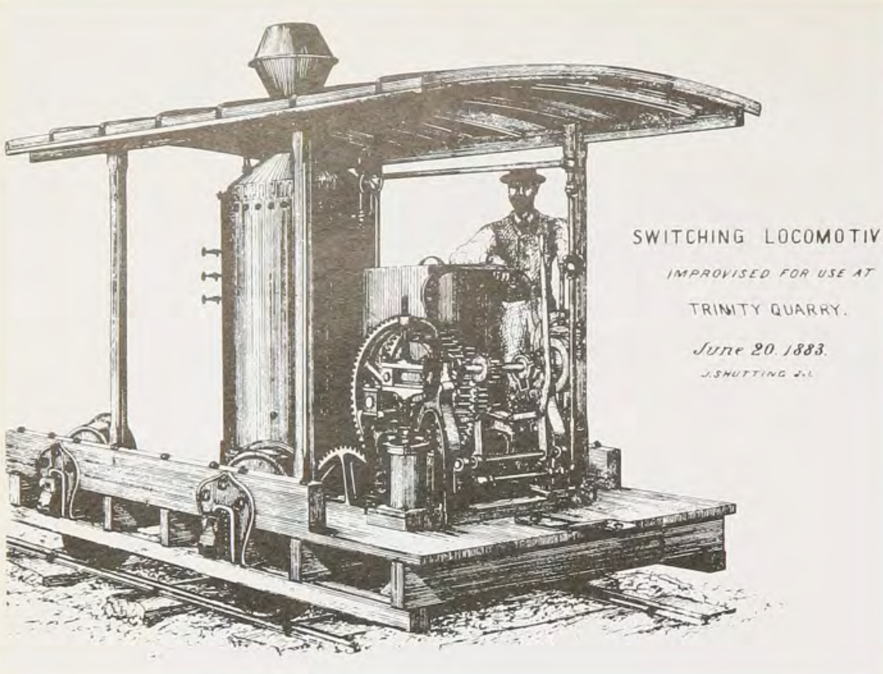
A more serious obstacle to progress at the project was the effect of "driblet appropriations" on the continuity of operations. The District Engineer bluntly

informed Washington "it is absolutely impracticable to conduct this work either satisfactorily or economically with such relatively small appropriations." Not only would the opening of the Tennessee be delayed for many years, he complained, but project costs would be sharply increased. His complaint was to little avail, however, for funding was never adequate and in some years all work at the canal was suspended because no money was appropriated at all.[15]

No doubt Major McFarland was elated to be reassigned to duty in the cool climes along the Canadian border in 1876. He was succeeded by Major William Rice King, the officer who had extinguished the fires in Richmond in April of 1865 and laid the second longest floating bridge ever constructed across the James. Major King directed the improvement of the twin rivers for a decade, the longest tenure of any Engineer officer assigned to command the Nashville-Chattanooga District. Major King made many significant engineering innovations at the Muscle Shoals Canal during his decade in charge of the project, and in his later career demonstrated the same original engineering ability while Commandant of the Engineer School from 1887 to 1895.[16]

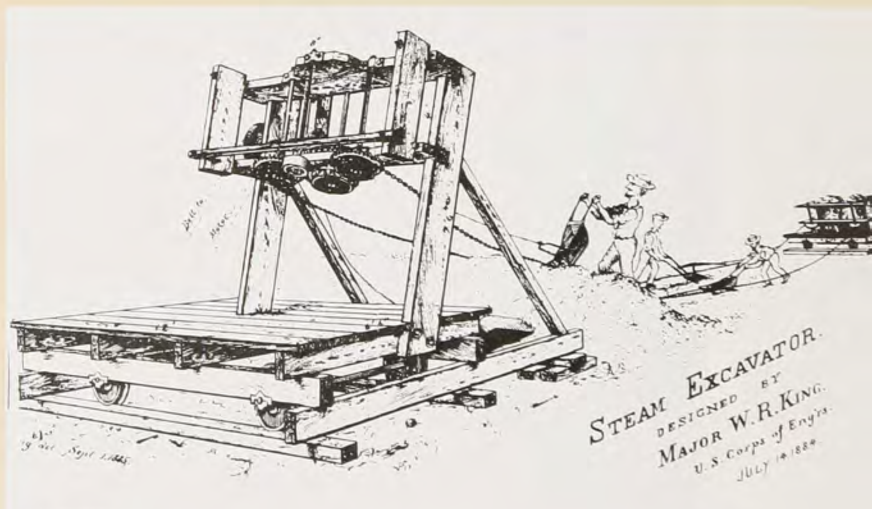
The most important of Major King's modifications of the Muscle Shoals project was the installation of a railroad track and telegraph line along the canal towpath. Instead of tenders at each lock, he envisioned two small parties of men at each end of the canal with a locomotive at a central location which could be

Excavation of Muscle Shoals Canal in August 1881. Spoil was shoveled into railcars running on temporary track laid on bottom of canal section. The work force was almost entirely black.



This small locomotive pulled small rail cars loaded with stone to and from the quarries in 1883.

The steam excavator designed by Major W. R. King in 1884 was used to dig the Muscle Shoals Canal. Chains pulled the scoops held and guided by men to move earth from the canal bed to the embankment.



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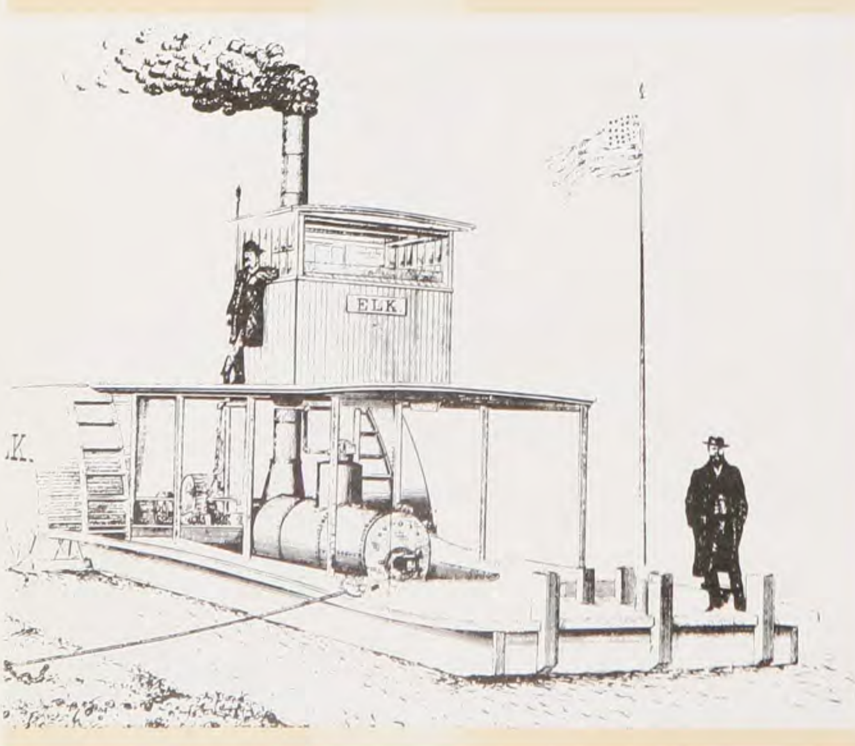


Steamboat *Elk*, built by the Engineers at Muscle Shoals Canal in 1884. It was 60 feet long, 11.7 feet wide, and drew 12 inches of water.

summoned to the end of the canal by telegraph when a steamboat approached. It could then tow the boat through, preventing some of the usual damage from careless handling of boats, and its power could be used to operate the lock-gates (with a rope and snatch-blocks).[17]

The project at Muscle Shoals, as constructed by Major King and his successors, consisted of sixteen miles of lateral canal and twelve miles of rock excavation and wing dam construction. Proceeding downstream, the Elk River Shoals were bypassed by a short, one and a half mile lateral canal with two locks; the Big Muscle Shoals were circumvented by a fourteen and a half mile reconstruction of the old Alabama canal, with its locks replaced by nine new and larger ones; and the Little Muscle Shoals were opened by blasting a channel and constricting the flow of the river with wing dams. The total of approximately sixteen miles of lateral canal made it the longest *steamboat* canal ever constructed.[18]

Major King could not direct the project alone; it would have been impossible, for he had charge of projects throughout the twin valleys. He had a highly competent staff of U. S. Assistant Engineers in charge of several construction divisions at the Muscle Shoals project and a young Engineer officer in immediate command of the project. This young officer designed a new gate for the locks which saved thousands of yards of masonry and lowered the cost of the project appreciably. This experience at Muscle Shoals launched the officer on a career which made him a national authority on canal construction. During his long service with the Engineers he made many departures in the art of concrete construction and patented devices such as the automatic movable dam, automatic lock-gate, and automatic emergency weir. A scion of the Kentucky branch of the Marshall family, he began his military service at age sixteen as a private in the Tenth Kentucky Cavalry (Union). Contracting typhoid in 1863, he left the cavalry and accepted an appointment to West Point, graduating in 1868. He came to the Muscle Shoals project in 1876 after participating in the exploration of the Far West with the Wheeler Expedition—a pass through the Rockies bears his name today. From private to Chief of Engineers, United States Army, truly his was a remarkable career—his name was William Louis Marshall.[19]

Lieutenant Marshall, Major King, and the Assistant Engineers had their hands full at the Muscle Shoals project; rampant disease and raging floods constantly harassed construction activities and in 1881 the project received another dubious distinction. It became the only Engineer project ever robbed by the notorious Jesse James gang.

March 11, 1881, was a rainy, windy Friday. Payday. And Alexander G. Smith, receiver of materials at Bluewater Camp, Muscle Shoals Canal, made his customary trip into Florence, Alabama, (about twenty miles) to pick up the payroll. On his return trip, he took the path alongside the canal which passed through a desolate wilderness, unbroken save by construction camps about four miles apart. Two miles from Bluewater Camp he dismounted to open a gate and was overtaken by three mounted strangers brandishing pistols, who cheerfully relieved him of his revolver and the payroll, amounting to $5240.80 in cash, and rode "hell-for-leather" toward the Tennessee line, forcing Smith to accompany them into the desolate barrens. After a twenty-mile ride, the men reined in the horses, dismounted and split up the loot, generously allowing Smith to keep his own money and gold watch, then left him to grope his way back to camp through the woods and a terrific rain storm during the night while they made their getaway.

Smith arrived back at camp at daybreak and the Engineers mounted up to ride hard in every direction in the hope of intercepting the bandits. The three desperadoes were well-mounted and had admitted to Smith they were old hands at their chosen profession. Though the Engineer posses pursued the robbers nearly to the Cumberland River, the rainstorm obliterated most of the tracks and further pursuit proved impossible. All Major King could do was telegraph authorities in nearby cities to be on the

lookout and notify the War Department of the robbery and await results.

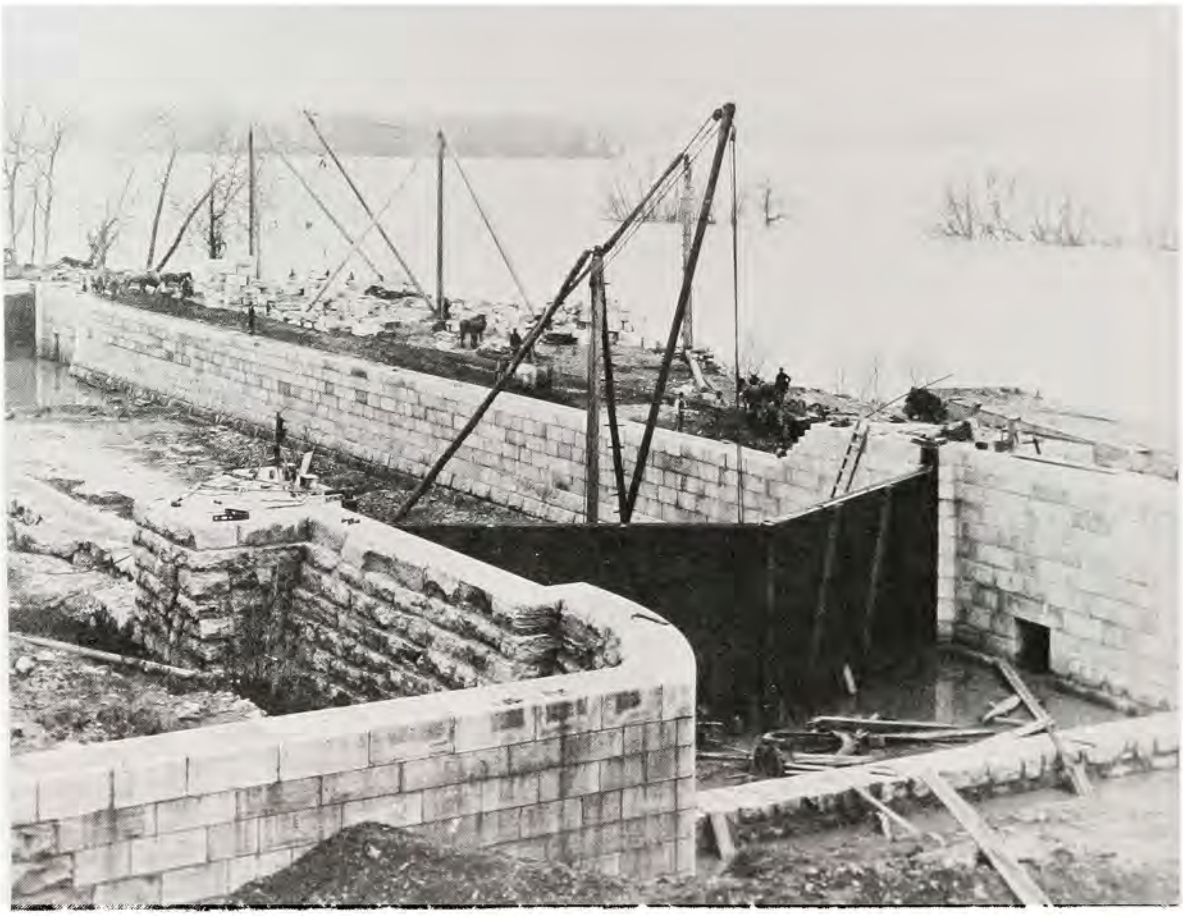
The first break in the case occurred when a man entered a saloon at Whites Creek near Nashville and ordered raw oysters and raw whiskey with predictable results—it took several strong men to disarm and subdue him. He was turned over to Nashville police, to whom he gave the name Thomas Hill, and the fifteen hundred dollars in gold found on his person brought him under suspicion in the Muscle Shoals case. Major King and Alexander Smith went to Nashville, where Smith identified Hill as one of the robbers. Missouri authorities identified Hill as a member of the Jesse James gang, whose name was William Ryan, alias Jack Ryan, alias Whiskey Head Ryan.

Major King recovered most of the money from Ryan and made a bit of inquiry in the vicinity on his own, learning the other robbers were probably still in Nashville, but he received no satisfaction from the authorities: the marshal refused to go after them because there was no detachment of soldiers to help him make the arrest, local authorities refused to give chase, and the Major had no funds to offer as a reward for their capture. He communicated with Secretary of War Robert Lincoln (son of the President), who asked and received the aid of the Justice Department, but the two robbers escaped into Kentucky and from thence into Missouri.

Whiskey Head Ryan was extradited to Missouri for trial there for other crimes, and Major King sorrowfully concluded

Muscle Shoals Canal lock under construction in 1885. The tiny Engineer steamboat *Elk* is behind the upstream lock gate.

Locomotive hauling material to Muscle Shoals Canal in 1885.



Construction of Lock A, Muscle Shoals Canal. Mules walking in circles pulled cables on the stiff-leg derricks to raise and place cut stone in the lock wall masonry.

the "other two robbers, and I fear, Ryan himself (for he was, at last advices, expecting to get released on bail), were doubtless engaged in the recent capture of the train near Winston, Mo., and as the governor has offered heavy rewards for them, they will probably be captured, though there is little prospect that any more of the money stolen at Muscle Shoals will be recovered."

Jesse and Frank James had maintained homes in the Nashville area from about 1875 to the capture of Ryan, Jesse under the name J. D. Howard and Frank under the alias B. J. Woodson, and only their long absences from home and fondness for fast horses attracted attention. But the robbery of the Engineers at Muscle Shoals and the capture of Whiskey Head Ryan forced them to give up their hideaway. They returned to Missouri where Jesse was assassinated in 1882 and Frank surrendered to the governor.

Meanwhile, in North Alabama, the scene of the robbery, a grand jury brought in an indictment on evidence provided by the Engineers and the U. S. Marshals against Jesse James, Frank James, William Ryan, Dick Liddil, and "divers other evil disposed persons to the Grand Jurors unknown." Liddil was arrested and returned to Huntsville, Alabama, for trial. Liddil confessed to being a member of the James gang, but claimed the Muscle Shoals robbery was committed by the James brothers and Ryan. The jury found Liddil guilty of complicity in the crime as a member of the gang, but the judge suspended sentence in order that Liddil might testify against Frank James.

Colonel William R. King, the District Engineer who built Muscle Shoals Canal, and, incidentally, chased the Jesse James Gang.

Frank was acquitted in Missouri, his case becoming a Confederate *cause celebre* because of his service with Quantrill's raiders, and then the Marshals took him to Huntsville to be tried for the robbery of the Engineers.

Several witnesses testified they thought James to be one of the three bandits who had waited near Florence for Smith to pass on the day of the robbery, and Dick Liddil turned state's evidence. Alexander Smith stated he believed Frank James was one of the robbers, but he could not be absolutely positive.

James had the aid of several fine attorneys: General Leroy Pope Walker, former Confederate Secretary of War, was one. James claimed he was in Nashville the day of the robbery and he produced several witnesses who corroborated his testimony. Thus, the jury's verdict really depended upon whose testimony they were willing to believe, and after five hours of deliberation the jury returned to deliver their verdict: "Not Guilty."

The Muscle Shoals case and the James gang were both simultaneously terminated. Frank James lived a respectable life until his death in 1915. Whiskey Head Ryan was sentenced to twenty-five years for train robbery in Missouri, but was released in 1889. His old habits caught up with him, however: he hit a tree limb while riding full gallop and fractured his skull.[20]

After a decade of arduous and sometimes exciting service on the Tennessee and Cumberland, Major King received a new assignment and Colonel John W. Barlow replaced him as Chattanooga District Engineer. The immediate direction of the Muscle Shoals Canal project passed, however, to a brilliant young officer who had graduated from the Military Academy in 1880. Shortly after his graduation, the Lieutenant had been introduced to General William Tecumseh Sherman, as was the custom in those days. General Sherman was quite cordial to the young officer until he learned he was joining the Engineers. "Oh, hell!" said Sherman. "However, in spite of that I hope you may do some good for your country some day." Lieutenant George W. Goethals did his best.[21]

Lieutenant Goethals made himself at home in Florence quickly, and though he seldom participated in social functions, he was often seen riding the steets in a pony cart with a disabled Confederate veteran he had befriended. He had a specific mission at Muscle Shoals, given him by the Chief of Engineers: get the canal open to traffic because an important rail rates hearing was soon to be held in Chattanooga and the opening of the canal would provide a year-round water route from Chattanooga to cities in the Mississippi and Ohio valleys—competition for the railways. Lieutenant Goethals organized two work shifts at the project to push construction night and day, taking personal charge of the "graveyard" shift himself. The Muscle Shoals Canal opened to traffic on November 10, 1890, and a steamboat passed through from St. Louis to Chattanooga before the rail hearing as the Chief of Engineers had ordered.[22]

The canal had been fifteen years (1875-1890) in construction, greatly exceeding the time which it should have taken, because of insufficient, and sometimes no, appropriations, continual flooding, a disease-ridden work force, problems with contractors, and irritating minor interruptions such as the fire of 1874 and the robbery of 1881. Some of the best officers in the Corps—Walter McFarland, W. R. King, William L. Marshall, John W. Barlow, and George W. Goethals—had been assigned to the project, but in spite of their best efforts navigational problems were still great on the Tennessee.

The citizens of Chattanooga held a mass meeting in 1891 to organize a steamboat company to operate boats which, they believed, would drive down railroad rates. The company sent the *Herbert* to St. Louis, but near the canal it struck a rock and sank; it was refloated only to strike a snag and sink again. Again, it was refloated and finally reached the mouth of the Tennessee where it found the Ohio River full of ice and impassable. But Chattanoogans were not discouraged: they rebuilt the *Herbert* as the *City of Chattanooga* and it made the run to St. Louis and back for several years. After the turn of the century, the Chattanooga Packet Com-

pany operated a regular schedule between its port city and rail terminals on the Ohio River, such as Joppa, Illinois, and Evansville, Indiana, but in 1910 an official of the company reported the company had met "a great many discouragements on account of opposition from the railroads, obstruction in the river, low water, and inefficient pilots. . . ."[23]

Shortly after the opening of the Muscle Shoals Canal a special Engineer District was created at Florence, with Captain George W. Goethals as District Engineer, with the dual mission of operating the Muscle Shoals Canal and planning another lateral canal a few miles down river at Colbert Shoals.

Muscle Shoals Canal became a beehive of Engineer activity, for besides the usual operation, maintenance, and repairs to the canal and its locks there were section gangs to maintain the fifteen miles of narrow-gauge railroad paralleling the canal, linesmen to keep the thirty miles of telephone wires connecting the locks and the Florence Office in repair, logging crews to cut timber for an Engineer sawmill, and a shipyard and drydock which constructed and repaired hundreds of towboats, barges, derrick boats, and other floating equipment. Also in operation were a machine and blacksmith shop, an Engineer mule stable, and an iron foundry, which in one year produced 20,061 pounds of iron

General George W. Goethals, who finished the Muscle Shoals Canal in 1890 and designed the highest-lift lock in the world at Riverton in the Colbert Shoals Canal. He thought that a bigger accomplishment than the little ditch he later dug across Panama.

UNITED STATES
MUSCLE SHOALS CANAL.
REGULATIONS.

EXTRACT FROM LAW OF AUGUST 17, 1894. Sec. 4. That it shall be the duty of the Secretary of War to prescribe such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are, or that hereafter may be, owned, operated, or maintained by the United States as in his judgment the public necessity may require.

Such rules and regulations shall be posted, in conspicuous and appropriate places, for the information of the public; and every person and every corporation which shall knowingly and willfully *violate* such rules and regulations shall be deemed *guilty of a* **MISDEMEANOR,** and, on conviction thereof in any district court in the United States within whose territorial jurisdiction such offense may have been committed, shall be punished by a fine not exceeding *Five Hundred Dollars*, or by *Imprisonment* (in the case of a natural person) not exceeding *six months*, in the discretion of the court.

1. **THE REGULATIONS** hereinafter prescribed are necessary in the use, administration, and maintenance of the Muscle Shoals Canal, and the Masters of all boats, and others using said Canal, are expected to yield their ready acquiescence and assistance in enforcing them. The general regulation, supervision, and control of the Muscle Shoals Canal rests in the Secretary of War, and any one guilty of the violation of these rules and regulations will be prosecuted.

2. **AUTHORITY OF CANAL OFFICERS.**—The movement of all boats and floating things in the Canal, the locks, and the approaches to the canal, shall be under the direction of the Canal officers.

3. **SIGNALS.**—All boats approaching the locks shall signal for the same by four distinct whistles of short duration, and shall not pass the point indicated by a sign-board until a signal is given by the lock-keeper.

4. **ENTRANCE TO LOCKS.**—When two or more boats or tows are waiting to enter the Canal or any of the locks, the lock-keeper shall have authority to designate the time and order of their entrance, and no boats or tows shall enter without his authority.

When more than one boat is waiting to enter a lock, the masters must ascertain from the lock-keeper when their turn will come.

Boats wishing to pass a lock shall not approach nearer than a fixed point—which shall be marked by a sign-board on the canal bank—until the signal is given to enter the locks, and they shall take position in rear of any boats, tows, or rafts that may precede them, and not in any way obstruct the channel.

5. **PRECEDENCE AT LOCKS.**—Ordinarily, boats and tows arriving first at the locks shall have the precedence in passing but in all cases boats and barges belonging to the United States, or employed upon public work, shall have the precedence over all others, and passenger boats shall have precedence over tows. Rafts shall have one lockage in their turn, except where there are two or more rafts together at a lock, in which case no part of a raft shall pass the lock until the whole of the raft or rafts preceding it shall have passed.

All boats, etc., arriving at the locks and not taking advantage of the first lawful opportunity to pass, shall lose their turn.

6. **MOORINGS IN LOCKS.**—All boats, when in the locks, shall fasten one head-line and one spring-line to the snubbing-posts on the lock-walls. Large boats shall use one head-line and two spring-lines, and the lines shall not be unloosed until the signal is given for the boat to leave the lock.

7. **DELAYS IN CANAL.**—No boat, barge, raft, or other floating craft shall tie up in, or in any way obstruct the Canal or its approaches, or delay entering or leaving the locks except by permission from proper authority. Boats wishing to tie up for some hours or days in the Canal must notify the officer in charge, through the lock-keeper, and proper orders in the case will be given. Boats so using the Canal must be securely moored in the places assigned them; and if not removed promptly on due notice, will be removed at the owner's expense by the canal officers.

All rafts or tows passing the locks in sections shall "make up" just below or above the lock.

8. **INJURY TO LOCKS OR FIXTURES.**—Boats shall use great care not to strike any part of the lock, or sluice walls, or any gate or appurtenance thereto, or machinery for operating the gates, or the walls protecting the banks of the Canal.

All boats using the Canal shall be free from projecting irons or rough surfaces that would be liable to damage the locks or any part of the Canal, and they shall be provided with fenders to be used in guarding the lock-walls, etc., from injury.

9. **HANDLING GATES.**—No one, unless authorized by the lock-keeper, shall open or close any gate or wicket, or in any way interfere with the employes in the discharge of their duties. But the lock-keeper may call for assistance from the master of any boat using the lock, should such aid be needed.

10. **DRAUGHT OF BOATS.**—No boat shall enter the Canal or locks whose actual draught exceeds the least depth of water in the channel of the Canal as given by the lock-keeper.

11. **MEETING AND PASSING.**—Meeting boats shall keep to starboard. Rafts must give to steamers the side demanded by a proper signal. Boats must not race or crowd alongside of each other while under way in the Canal.

12. **BOATS AND RAFTS WITHOUT STEAM.**—No raft or boat shall be brought through the Canal unless accompanied by a steamboat, except small boats controlled by sails or oars; and small boats used for private purposes shall not pass the locks except by permission.

13. **REFUSE IN CANAL.**—No person shall throw stone or material of any kind into the Canal or locks, and boats passing through shall not deposit the ashes or cinders from their furnaces in the Canal or locks.

14. **TRESPASS.**—No one shall trespass upon the Canal property, or in any way injure the Canal, the locks, or any of the appendages.

15. **COMMERCIAL STATISTICS.**—Masters or clerks of boats shall furnish, in writing, to the lock-keeper at Lock No. 6 of the Canal, such statistics of passengers and cargo as may be required.

APPROVED:

DANIEL S. LAMONT,

January 26, 1895. SECRETARY OF WAR.

Lock 2, Muscle Shoals Canal in May 1889. Lock operators traveled on the hand-powered section car in foreground.

Engineer towboat *Lookout* barging coal across Shoal Creek Aqueduct of Muscle Shoals Canal.

Muscle Shoals Canal near Lock 6.

castings and 525 pounds of brass castings.[24]

Muscle Shoals Canal was the first permanent installation operated by the Engineers in the twin valleys, and it was afflicted with many problems similar to those the Engineers must cope with today. In 1895, as example, Captain Theodore Bingham, the District Engineer, reported log raftsmen at the canal disregarded all regulations for its use. "They get drunk," he said, "abuse the canal employees, discharge their fire arms and frequently attempt to capture the entire plant, careless of any damage inflicted on the lock masonry, lock gates, lever of sluices, &c." To curb this "insupportable nuisance," Captain Bingham ordered that all log rafts passing through the canal be accompanied by a steamboat. The incident was merely one example of a perennially vexatious problem which has endured, for it seems that many Americans believe Engineer projects are for their benefit alone, forgetting that the balance of the community has an equal interest.[25]

District Engineer Goethals, in 1891, turned his attention to the project for construction of a lateral canal around Colbert Shoals below Florence, and he designed a lock with an extreme low-water lift of twenty-six feet, the greatest ever attempted in the United States up to that time; indeed, there was opposition to its size in Washington, but approval was extended and the Riverton Lock, as constructed, provided a lift of nearly twenty-six and a half feet. It has been said the precedent set at Riverton Lock led directly to the great locks of the Panama Canal.[26]

Riverton Lock was placed at the lower end of an eight-mile lateral canal which bypassed Colbert and Bee-Tree Shoals. Construction began in 1891 with the award of a contract to the lowest bidder, over the vehement protests of Captain Goethals who believed the low bidder was incapable of accomplishing the work. The contractor began excavation for the lock pit, but foundation rock was beneath many feet of earth and quicksand; the sheet-piling around the pit collapsed, the earth behind slid into the pit, and the contract was annulled.

Steam powered crane used in 1895 during construction of Colbert Shoals Canal, Tennessee River.

Captain Goethals employed day labor and placed Sydney B. Williamson in local charge of construction.[27]

Captain Goethals, a stickler for proper discipline, went to the site of Riverton Lock one morning and was shocked to find Assistant Engineer Williamson down at the very bottom of the lockpit, wielding a shovel with the laborers, but the officer restrained his anger until dinner when he could privately demand an explanation. Sydney Williamson explained that, since it was desirable to get down to bedrock, it was therefore necessary for him to get into the muddy hole, because the laborers were so frightened of a cave-in that a good example was imperative. This put a different light on the matter—leading men personally into danger was not fraternization—and thereafter Williamson accompanied Goethals on every important project to which he was assigned.[28]

During the Spanish-American War, Williamson became a Captain on General Goethal's staff; in 1907 Goethals took Williamson to Panama with him and placed him in charge of one of the three construction divisions at the project. Williamson's division set the canal record for concrete yardage and economy. During World War I, Williamson commanded the 55th Engineer Regiment in France, and afterwards served as a member of the Interoceanic Canal Board

and the Board of Engineers for Rivers and Harbors. Shortly after his death in 1939, the Panama Canal Zone released a postage stamp bearing his portrait.[29]

Captain Goethals was reassigned to other duties before completion of the Colbert Shoals Canal and the Engineer District at Florence was abolished. The people of the region had grown fond of the young officer and Confederate General—United States Congressman Joseph Wheeler appealed to the Chief of Engineers for a revocation or postponement of Captain Goethals' change of station, declaring "if Capt. Goethals is taken away, we shall all be very despondent." But General Wheeler's request was denied and the Captain departed to travel the road to Panama and international fame.[30]

In later years, after General Goethals had completed the construction of the Panama Canal, he remarked the project at Muscle Shoals loomed far greater in his memory than the work at Panama, for it had been his first important assignment.[31]

The project at Colbert Shoals suffered the same variety of maddening delays which had afflicted the Muscle Shoals Canal project. In 1897 the construction site at Colbert Shoals was inundated and heavily damaged by the highest flood of record on that section of the Tennessee, and in 1898 and 1899 work at the project was halted six times by floods. Work stoppages were so frequent that the laboring force became demoralized and left for more regular work elsewhere. One of the contractors on the project had

A sharp turn in the Colbert Shoals Canal, Tennessee River, about 1900. Inspectors are standing on the concrete wall next to the waste weir. Colbert Shoals are in the background.

Engineer dock and repair shop on Colbert Shoals Canal about 1905. Engineer steamer *Colbert* moored on opposite bank. The barge in foreground is under construction or repair, with an unidentified steamer behind it.

his contract annulled because he was the victim of the first recorded strike on an Engineer project in the twin valleys (1895), and other contractors simply failed. Between March, 1899, and June, 1902, there were no appropriations for the project, forcing a three-year hiatus in construction, and when appropriations were made they were so meager as to seriously hamper the progress of the work.[32]

When Colbert Shoals Canal finally opened to commercial traffic on December 4, 1911, the construction of lateral canals to conquer the obstructions in the Tennessee River was ended, for the combined power and navigation dam at Hales Bar near Chattanooga, Tennessee, which inaugurated the development of the river for multiple purposes, was nearing completion.

The lateral canal projects on the Tennessee were often criticized for their "uneconomical" benefit-cost ratio; that is, for the high cost to the government of constructing and maintaining the canal projects in comparison to the amount of river traffic which utilized the canals. Critics had forgotten the canals were authorized largely on the basis of the social values inherent in the projects, not on a benefit-cost basis or any other of the modern project justification criteria. They also ignored the fact that the canal projects were designed to facilitate a regular schedule for through traffic on the Tennessee and were not utilized by the traffic at higher water stages.

During the twenty-eight years the Muscle Shoals Canal operated (1890-1918), only a little over 300,000 tons of freight valued at about $16,000,000 passed through it, but the total commerce on the river below Chattanooga during approximately the same period was nearly 6,000,000 tons valued at over $200,000,000.[33]

The era of canal construction on the Tennessee River was marked by many precedent-setting engineering feats, and, though the contributions of the canals to commercial navigation remain debatable, the work of the Engineer Department at Muscle and Colbert

Riverton Lock, Colbert Shoals Canal, Tennessee River, had a 26.5 foot lift, the highest lock-lift of record at the time George W. Goethals designed it.

The St. Louis and Tennessee River Packet Company's *Alabama* locking through Riverton Lock on Colbert Shoals Canal, on June 24, 1913.

Shoals, whether in construction feats, combating the dangers of flood and pestilence, or chasing the James gang, is still a source of pride to the Engineers of the Nashville District.

The canal construction projects on the Tennessee did, as predicted by Colonel Gaw, General Weitzel, and Major McFarland, contribute to the general renewal of hope and revival of trade and industry in the Tennessee Valley after the Civil War. And, as also predicted after the war, they did contribute toward a renewal of the bonds of union. A great change occurred during the course of the work: an Engineer was fired in 1870 for alleged "Copperhead" sympathies, but by 1895 many ex-Confederates were employed on the project and were bewailing the loss of their favorite Engineer officer, Captain Goethals.

Lateral canals were not the solution to the navigational problems of the Tennessee, and they were quickly abandoned when modern engineering made multipurpose development possible. But in their time they made undeniable contributions to engineering knowledge and to the progress of the Tennessee Valley. The revival of interest in the Southern Route in modern times—the Barkley Canal and the Tennessee-Tombigbee Waterway—proves the vision of men like Major Walter McFarland still lives in the United States Engineer Department today.

SPECIAL ORDERS, }
No. 191. }

HEADQUARTERS OF THE ARMY,
ADJUTANT GENERAL'S OFFICE,
Washington, August 18, 1888.

1. By direction of the acting Secretary of War Captain *Frank Baker*, Ordnance Department, will proceed from Frankford Arsenal, Philadelphia, Pennsylvania, to the powder mills of *E. I. Du Pont & Co.*, near Wilmington, Delaware, on public business in connection with the inspection of powder, and on completion of this duty will return to his proper station. The travel enjoined is necessary for the public service.

2. By direction of the acting Secretary of War the following changes in the stations of officers of the Corps of Engineers are ordered:

Lieutenant Colonel *John W. Barlow*, from Chattanooga to Nashville, Tennessee.

Captain *William L. Marshall*, from Milwaukee, Wisconsin, to Chicago, Illinois, to take effect not later than October 1, 1888.

The travel enjoined is necessary for the public service.

3. By direction of the acting Secretary of War paragraph 11 of Special Orders, No. 186, August 13, 1888, from the War Department, Adjutant General's Office, relating to 1st Lieutenants *Garland N. Whistler, Oliver E. Wood*, and *William R. Hamilton*, 5th Artillery, is revoked.

4. Paragraph 1 of Special Orders, No. 160, July 12, 1888, from this office, is so amended as to transfer 1st Lieutenant *William B. Homer*, 5th Artillery, from Battery E to Battery G of that regiment, *vice* 1st Lieutenant *Oliver E. Wood* from Battery G to Battery E; and so much of said order as relates to 1st Lieutenant *William R. Hamilton*, 5th Artillery, is revoked. Lieutenants *Homer* and *Wood* will exchange batteries in accordance with the terms of the order specified.

BY COMMAND OF MAJOR GENERAL SCHOFIELD:

R. C. DRUM,
Adjutant General.

OFFICIAL:

Assistant Adjutant General.

CHAPTER VIII

CANALIZATION OF THE CUMBERLAND

The completion of the Abert-Weitzel survey of the Cumberland River in 1871 was followed by a series of appropriations, averaging $25,000 annually, for the regulation of the river by open-channel methods. The Cumberland River Project was supervised by General Godfrey Weitzel at Louisville, Kentucky, and, after 1873, by Major Walter McFarland at Chattanooga.[1]

General Weitzel adopted the contract system for the improvement of the Cumberland, but it failed on the Cumberland as it did on the Tennessee, because of the high incidence of cholera, malaria, and other diseases among the laborers and the inadequacy of equipment and inexperience of the contractors. Major McFarland terminated the contracts, employed hired labor, and dispatched Captain Lewis Cooper Overman, Corps of Engineers, to Nashville to supervise operations on the Cumberland. Captain Overman established the Office of the Cumberland River Improvement at 32 North College Street (3rd Ave., North) in Nashville on October 9, 1873, thus inaugurating the history proper of the Nashville District as a suboffice of the Chattanooga District, a situation which was to be reversed in 1888.[2]

Captain Overman understood the art of gracious living. He took up residence amidst the plush atmosphere and luxurious cuisine of Nashville's renowned Maxwell House, where he had the wisdom to remain throughout the seven years he directed the Cumberland River Project. The Engineer Office changed locations several times during these years, moving to 93 Church Street in 1880 and to 609 Broad Street in 1882, where it remained until after the suboffice became the Nashville District in 1888.[3]

The open-channel method of regulating the Cumberland for the benefit of navigation had certain advantages: it was economical, could be accomplished quickly, and cleared the channel of the most dangerous obstructions—snags and boulders—but it could never provide an adequate channel depth for year-round navigation by deep-draft vessels. Therefore, not long after the Civil War alternative methods of river improvement were being debated and tested. W. Milnor Roberts of the Engineer Department recommended a slackwater lock and dam project for the Ohio River in 1870, and in 1874 Major William E. Merrill (chief engineer of the Army of the Cumberland, 1864-65) recommended the installation of a movable dam, which could be lowered to permit the passage of river traffic during the higher water stages. Merrill's dam was constructed on the Ohio River at Davis Island from 1878 to 1885, inaugurating the canalization project (installation of locks and dams) for the Ohio River which was completed in 1929.[4]

Engineers on the Cumberland eagerly seized upon the idea of locks and dams to facilitate year-round navigation on the river, and in 1881 a survey was ordered of Smith's Shoals near Burnside, Kentucky, to ascertain the practicability of install-

Paragraph 2 of Special Orders No. 191, August 18, 1888, established the Nashville Engineer District. Engineer officers had been stationed at Nashville continuously, however, since 1873.

The Trousdale building at 609 Broad Street in Nashville was the first District office, 1888.

Congress ignored the Major's reservations and appropriated $50,000 to initiate the canalization of the Cumberland, but Major King was enraged by the tiny size ing a slackwater system to submerge the Shoals. This was followed in 1882 by an act which directed an investigation of a slackwater, canalization project for the Upper Cumberland from Nashville to Smith's Shoals. The result was a favorable report, proposing thirty locks and dams for the Upper Cumberland, twenty-three between Nashville and Burnside and seven at Smith's Shoals, but the officer in charge of the improvement, Major William R. King, also pointed out the project would be very expensive (over $4,000,000) and the dams would hinder descending traffic—log-rafts and flatboats—and he asked if a smaller sum might not be expended more profitably in further deepening the channel by regulation, rather than canalization.[5] of the appropriation, bluntly declaring publicly: "Above Nashville only $50,000 have been appropriated for a system of locks and dams estimated to cost over $4,000,000, at which rate it would take eighty years to complete the work." He was quite correct, but his complaint and those of his successors had little effect, with the result that only nine of the proposed thirty locks and dams above Nashville were ever constructed and forty years passed before even they were completed.[6]

The proposed slackwater system at Smith's Shoals was designed to aid the movement of coal barges down to Nashville from the mines above Burnside, where hard, bituminous, gas coal had been mined since 1807, as was the open-channel work the Engineers had engaged in at the Shoals from 1873 to 1881. The adoption of the slackwater project was delayed when the Common-

wealth of Kentucky chartered the Cumberland River Improvement Company in 1882 to build locks and dams on the Upper Cumberland, but the company never got into operation and its charter was repealed. Congress would do nothing at the Shoals while such a corporation existed, and the delay appears to have ended any real possibility that Smith's Shoals might be canalized; for the coal commerce was rapidly shifting from river to rail.[7]

Still, the slackwater project at Smith's Shoals continued to intrigue the Engineers and the sites of the seven proposed dams were located. As late as 1892, the Nashville District Engineer suggested authorization of the project by Congress, apparently in the hope that concrete action towards improvement of navigation at the Shoals might encourage a renewal of the coal commerce, but no appropriations were forthcoming from Congress. Coal mine interests took matters in their own hands in 1905 and formed the Cumberland River Improvement Company to construct locks and dams on the Cumberland and Big South Fork, but the company never constructed anything; indeed, its sole achievement was to end forever all hopes that the Cumberland would be canalized at Smith's Shoals.[8]

Major William R. King left the twin valleys in 1886 and Colonel John W. Barlow assumed command of operations on the Cumberland and Tennessee, taking up station at Chattanooga until he moved to Nashville in 1888 to become the first Nashville District Engineer. Colonel Barlow, a combat engineer who had participated in the Battle of Bull Run,

General John W. Barlow. He fortified Nashville in 1864 and returned in 1888 to become first Nashville District Engineer.

the Peninsular Campaign, the Battle of Atlanta, and the Battle of Nashville during the Civil War, had served after the war as General P. H. Sheridan's chief engineer in the Far West and led a detachment of Engineers in the first exploration of the Yellowstone. He eventually became Chief of Engineers, United States Army, in 1901.[9]

When Colonel Barlow began work at Chattanooga in 1886, his right-hand man in charge of the improvement of the Cumberland at the Nashville suboffice was Assistant Engineer Charles A. Locke, a veteran of Forrest's Confederate cavalry. The cooperative endeavors of two veterans like Barlow and Locke, who would have shot each other on sight in 1865, to improve navigation on the twin rivers illustrates the unifying effect river and harbor improvements could have. Charles Locke was one of the founders of the Engineering Association of the South (1889), of which Colonel Barlow was also a member, and after his resignation from the Engineer Department he engaged in pioneer work in the Southern phosphate industry and in the development of portland cement.[10]

In 1887, the two Engineers prepared designs for the first lock and dam on the Cumberland, to be constructed just below the Nashville harbor (Lock and Dam No. 1), and they came to the conclusion, on the advice of boatmen, that lock chamber dimensions of 60 by 250 feet were larger than necessary for the traffic, would increase costs, and would delay completion of the project because of the small size of appropriations. A Board of Engineer Officers met in Nashville to consider smaller dimensions for the locks and rejected them peremptorily. The members of the board—Colonel Orlando M. Poe, hero of the Battle of Knoxville; Lieutenant Colonel William E. Merrill, chief engineer of the Army of the Cumberland during the Civil War; and Major W. R. King—allowed a narrower width of 52 feet, but increased the length of the lock chambers to 280 feet. Colonel Poe astutely observed:

> Past experience teaches that the requirements of commerce have demanded enlargement of the projects originally submitted. In this case the majority have deemed it judicious to pass at once to the dimensions adopted on other like works. They attach no importance to the opinions of river navigators touching this question, as these very men would be the first to build larger, and therefore . . . economical boats, and then blame the engineers for having failed to provide sufficient accommodations.[11]

Colonel William E. Merrill, chief engineer of the Union Army of the Cumberland and first Ohio River Division Engineer.

Colonel Poe's prediction was absolutely correct, for even the larger locks became a bottleneck to traffic on the Cumberland in the twentieth century. Boats constructed at Nashville had to be floated over the dams during high water in order to enter service on other inland waterways (and during World War II on the oceans), and barges as large as 50 by 290 feet were constructed, passing through the locks on the Cumberland with only one foot clearance on each side and the bow and stern projecting over the miter sills of the locks.[12]

With the dimensions of the locks set and the timber-crib, stone-filled type dam approved by the Board of Engineers, the canalization of the Cumberland began in

The Nashville District Office moved into the Federal Customs House at Nashville in 1906.

1888. As it began, at the urgent request of the Cumberland River Commission, the Engineering faculty at Vanderbilt University, and various legislators, Special Order No. 191, August 18, 1888, directed Colonel Barlow to change his station from Chattanooga to Nashville, thus creating the Nashville District, Corps of Engineers. Citizens of Chattanooga were upset by the move and held a mass meeting to protest it, but Colonel Barlow explained to them the work at Muscle Shoals Canal was nearing completion and the extensive slackwater project commencing on the Cumberland required his presence, adding that a suboffice would be maintained at Chattanooga under his supervision.[13]

Colonel Barlow moved to Nashville, making his home at 1413 McGavock Street, and opened the office of the Nashville Engineer District at 609 Broad Street (Trousdale Building, now demolished) on October 1, 1888. The office was moved to the northwest corner of 8th Avenue and Broad in 1891, where it remained until 1906 when it moved to the Federal Office Building on the southwest corner of 8th and Broad.[14]

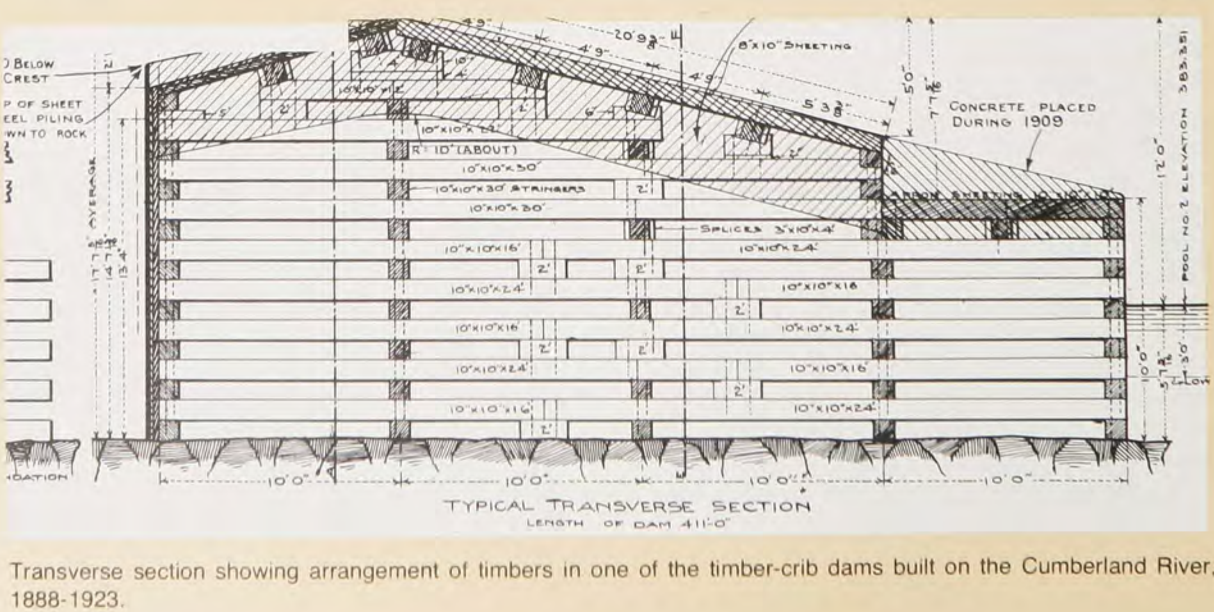
Colonel Barlow brought with him seven men from the Chattanooga Office. One of them was Chief Clerk Henry N. Darling who had served under Major McFarland, Major King, and Colonel Barlow at Chattanooga. Darling was the first of three Chief Clerks, Abe Goodman and Walter F Harbison were the others, to serve as Chief Clerk of the Nashville District before the title of the position was changed to Administrative Assistant and its responsibilities altered.

An Engineer officer who served in the Nashville District stated after his retirement that in forty-one years service, handling millions of dollars, he had never lost a single penny because of an error by his chief clerks. No position in the Engineer Department today is quite comparable to Chief Clerk; their duties included serving as the District's liason with the public, being an authority on all forms of official records, rules and regulations of the War and Treasury Departments, rulings and opinions of the Comptrollers and Auditors, and verifying and preparing vouchers and checks for the District Engineers. It was perhaps the most "ulcerous" position in the Engineer Department.[15]

The transfer of the Engineer Office to Nashville in 1888 occurred in the midst of a huge wave of enthusiasm in the Cumberland Valley for the canalization project. Local newspapers urged the "ancient doctrine of strict construction" of the Constitution be abandoned and the pressure of public opinion be applied on congressional representatives for larger appropriations for the slackwater system. In 1889 the Cumberland River Improvement Association was organized to "impress upon Congress the merits" of the canalization of the Cumberland.[16]

This widespread public support for the project may have had some influence, because there was some small increase in the amount appropriated annually for the Cumberland and in 1888 an examination of the Lower Cumberland, below Nashville, was ordered to ascertain the practicability of also canalizing that stretch of the river. Of course, a slackwater project for the Lower Cumberland was necessary: 1889 was the record year for steamboat traffic on the Cumberland.[17]

Construction of Lock 1, Cumberland River, on October 31, 1891. The barrels may have contained cement; the horse turned the drum winding cables to raise the cut stone into place.



Transverse section showing arrangement of timbers in one of the timber-crib dams built on the Cumberland River, 1888-1923.

Assistant Engineer Charles A. Locke supervised the survey of the Lower Cumberland for locks and dams, with a party of seventeen men who floated down the river in two flatboats. By the time they arrived at Smithland almost every man in the survey party had contracted malaria, but Locke and his men produced an excellent report on the lower river which called for the construction of seven locks and dams, identified by the letters A to G (A was nearest Nashville; G nearest Smithland, but the latter was never constructed because an increased lift was later designed into the locks). Lock chamber dimensions (52 X 280 feet) corresponded with those above Nashville and the dams were of the same timber-crib, stone-filled construction. Congress authorized the canalization of the Lower Cumberland in 1892 and appropriated funds for the construction of Lock and Dam A at Harpeth Shoals.[18]

Colonel John Barlow was promoted to Division Engineer and left the District in 1891, succeeded in the latter post by the famous author of the "Bible of Parliamentary Proceedings," Colonel Henry M. Robert, who had published the first edition of *Robert's Rules of Order* twenty years before he came to Nashville. District employees often comment the Colonel probably found great use for his book while serving in the District, and it is true that he revised the book while at Nashville.[19]

Colonel Robert was a delightful gentleman, a sort of father to the younger officers of the Corps by 1891. Captain George Goethals, at Florence, was

General Henry M. Robert, Nashville District Engineer, 1891-1893. Author of *Robert's Rules of Order*.

extraordinarily fond of the Colonel and delighted in reciting a story about an occasion when Colonel Robert reprimanded a younger officer for speaking disrespectfully of a senior officer. The young man hastily explained: "Why, Colonel, I never spoke disrespectfully of a superior in my life, not even of Colonel ________, damn his old soul."[20]

Colonel Robert immensely enjoyed his stay in the "Athens of the South," where he found an intellectual atmosphere congenial to his interests. He did a great deal of work with the literary societies of Peabody Normal College (now George Peabody College for Teachers), and made many fast friends throughout the Tennessee and Cumberland valleys. After the Colonel was transferred to other duties, Congressman Joseph Wheeler of Alabama had the temerity to request his aid in a contested election, declaring that a "written statement of the law and a citation of authorities from you would carry great weight, as it would be a statement by a man who is known as an authority on the question of parliamentary law."[21]

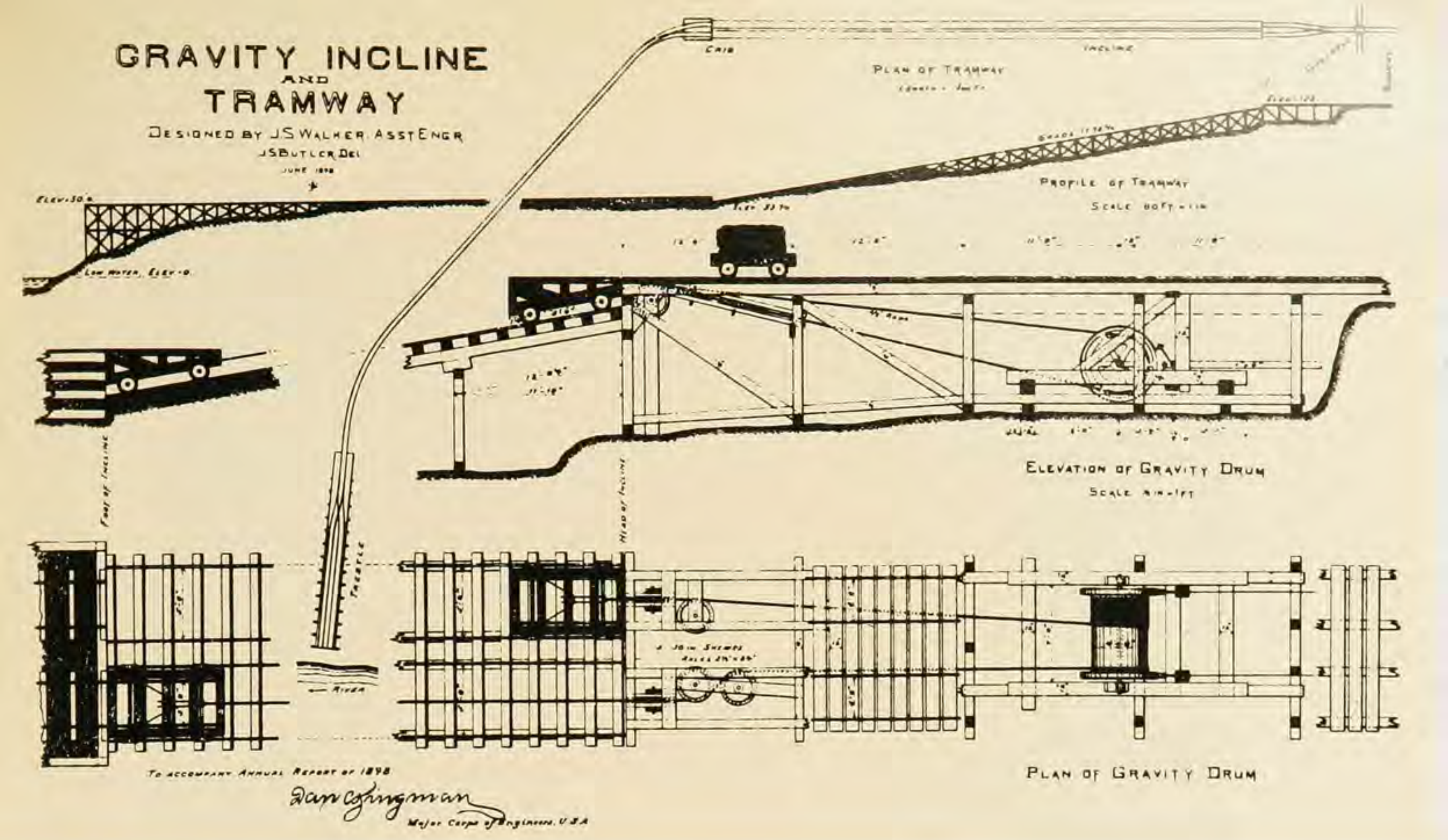
Under Colonel Robert's direction, the canalization of the Cumberland got fully underway, with construction beginning at Lock and Dam No. 1 and Lock and Dam A, the two projects nearest Nashville. It may seem strange that the canalization project should have begun in the middle section of the river, but Lock and Dam No. 1 created a pool for Nashville, the busiest harbor on the river, and Lock and Dam A covered the Harpeth Shoals, the greatest obstruction to navigation on the Lower Cumberland. Besides, the lower section of the river was the deepest and easiest to navigate, while the trade above Nashville consisted largely of coal barges and log rafts which floated down river on the crest of a rise.[22]

With the exception of Lock and Dam No. 21 near Burnside, Kentucky, constructed after the turn of the century, all six dams below Nashville (A-F) and the eight (Nos. 1-8) above were similar in construction. Ten-foot square timber cribs, much like log cabins, except pinned rigidly in place at the corners by long steel rods, were built and dropped into the river side by side and filled with stone. A cap of ten-inch square timbers was pinned atop the cribs to keep the stones in place (concrete caps were later added to some), a water-tight lumber (later steel) sheeting was driven to rock on the upstream face of the dam, and boulders were placed above and below the dam to further stabilize it.[23]

The first locks constructed were built of massive, hand-cut, stone masonry, while the later ones were of concrete, and all were of the same dimensions, except that the lifts varied slightly. For the most part, they were works of fine craftsmanship. A few of the landward-walls of the old locks are still visible in upper reservoir pools on the Cumberland, and one can not but be impressed by the high quality worksmanship; truly, they were built for the ages by men who knew stone. Doubtless the old locks and dams would still be in service had not multipurpose development and an enormous increase in commerce rendered them obsolete.[24]

The man who had most to do with this fine worksmanship was Principal Engineer John Simpson Walker, who began his service for the Engineer Department in 1872 on a survey of the Tombigbee River, where he spent ten days cutting his way with a machete through a dense cane-brake at a rate of about 1500 feet per day. Walker, son of Confederate States Senator and Alabama Superior Court Judge Richard W. Walker, received his education at the University of Virginia, and, though not a graduate engineer, his fine mind, insatiable reading habit, and native common sense carried him to the top of his profession. However, he did not find cutting his way through cane-brakes particularly challenging and he left the Engineers to engage in railroad construction in Mexico, but when the Muscle Shoals Canal project got underway he returned to supervise the construction division at Elk River Shoals. When Assistant Engineer Charles A. Locke left the Department, Colonel Barlow chose Walker as Principal Engineer on the Cumberland, in which position he remained until retirement in 1922.[25]

John S. Walker was a jovial fellow, tall, stout, with an uncontrollable beard. He



Incline designed in 1898 by J. S. Walker and J. S. Butler for delivery of stone from quarry to Cumberland River Lock 5.

spent much of his time reading in his office, propped back in a swivel chair with a stogie filling the air with blue haze. Revolving cases of reference books were conveniently located by his desk, but he carried in his head the plans and specifications for most of the locks and dams in the United States. His scholarship won him a prize for the best article on river and harbor engineering published in 1911. It was in this same year that the Nashville District set a national precedent by arranging a convention of waterways engineers in Nashville to discuss common problems in waterways development. John Walker was also quite active in Nashville community affairs and was honored at his retirement with the presentation of an inscribed walking-cane by the grateful people of Nashville.[26]

One of the most difficult problems met by the Engineers as the Cumberland canalization project progressed was finding proper dam-site locations. The techniques of core-drilling and extensive geological investigation of foundations were not fully developed until the twentieth century, and foundations were tested merely by driving steel rods through the overburden to rock to ascertain its depth below the surface.

It has been said by employees who witnessed the selection of dam-sites that Mr. Walker would rove over the river bank, then stop, spit at a spot, and say, "Boys, we'll put it there." This is a slight exaggeration, but techniques were primitive. District Engineer John Biddle wrote in 1894 it "was certainly absurd to accept a lock-site on six borings with a rod," referring to the site of Lock and Dam D (part of the dam was eventually based on wooden piles driven into a compact gravel formation to rock). The site of Lock and Dam F was also shifted downstream after a cofferdam had been unwatered and the true character of the foundation revealed. This gap in engineering knowledge fortunately caused no grave difficulties on the Cumberland, but it had more serious consequences on the Tennessee.[27]

Colonel Barlow predicted when the Cumberland canalization project began in 1888 that the Engineers' experience

An improved landing on the Cumberland River at Bluff Landing, Kentucky. Three hogsheads of tobacco and about thirty hogs were waiting for loading on the first lucky steamboat to arrive.

on the Tennessee "with contract work was not such as to commend that method, and it is very doubtful if it would prove satisfactory on the Cumberland." He was correct, for both the contract system and the hired labor system were utilized in the canalization project and the former did prove generally unsatisfactory both to the contractors and the Engineers.[28]

To prevent collusion among contractors, the District punctiliously enforced precise rules on bidding: bids were to be in sealed envelopes and inserted through a slot into a locked box, which was closed by a clerk with a stopwatch at the exact second called for by the rules. Once, a bid was halfway through the slot when the clerk slammed down the panel closing the box. He snipped off the portion of the envelope remaining outside, creating a considerable hassle over the legality of the bid, but since the bid price was written on the half inside the box it was accepted, and, as it happened, it was the low bid.[29]

The work of the contractors was meticulously but impersonally inspected by the Engineers, who held them strictly to the specifications. Contractors were required to submit cubic-foot sample boxes of materials they proposed to use in construction, and one contractor on a lock above Nashville foolishly selected the best rock in his quarry and polished it before placing it in the sample boxes. The bulk of the rock was not of the same quality and was rejected by the inspectors—the contractor bankrupted and the District completed the job, using the same stone it had rejected.[30]

On the other hand, a contractor at Lock D on the Lower Cumberland added a handful of twigs and trash to each

sample box, which was accepted by the District as honesty. At first the rock used at the job was perfectly clean, but a rise in the river added debris to the gravel which the inspector rejected. The contractor drew his attention to the debris in the sample boxes, but the inspector was not satisfied and had an entire barge of gravel sifted by hand. He was forced to admit the ratio was about the same as that in the sample boxes and accepted the material. But even this contractor, who did the best work on the Cumberland, according to the Engineers, claimed he lost $20,000 on the contract at Lock D. Another contractor who had a similar experience with work for the Engineer Department advised his son that "if your government needs you, give it the last drop of your blood, but don't do business with it."[31]

One of the important advantages of construction of waterways projects by the Corps of Engineers is the fact that in national emergencies a large number of highly trained engineers, thoroughly familiar with military procedures, is available for immediate mobilization to cope with the emergency. The first incident of this nature occurred in 1898, and, as previously noted, several Nashville District employees followed the colors with the combat engineers.[32]

Log raft on Cumberland River above Nashville. Photo taken in 1932 by Colonel William Darden of Nashville District.

The District Engineer in 1898, Captain John Biddle, went to Camp Thomas at Chickamauga Park, Georgia, to join the staff of General James H. Wilson, the Engineer officer who had commanded the cavalry at the Battle of Nashville in 1864. Captain Biddle captured the town of Coamo, P. R., in August of 1898, and, with the Fourth Tennessee Volunteers, accepted the surrender of 20,000 Spanish troops at Matanzas, Cuba. The Captain became Superintendent of the United States Military Academy in 1916, and during World War I served as Acting Chief of Staff, United States Army.[33]

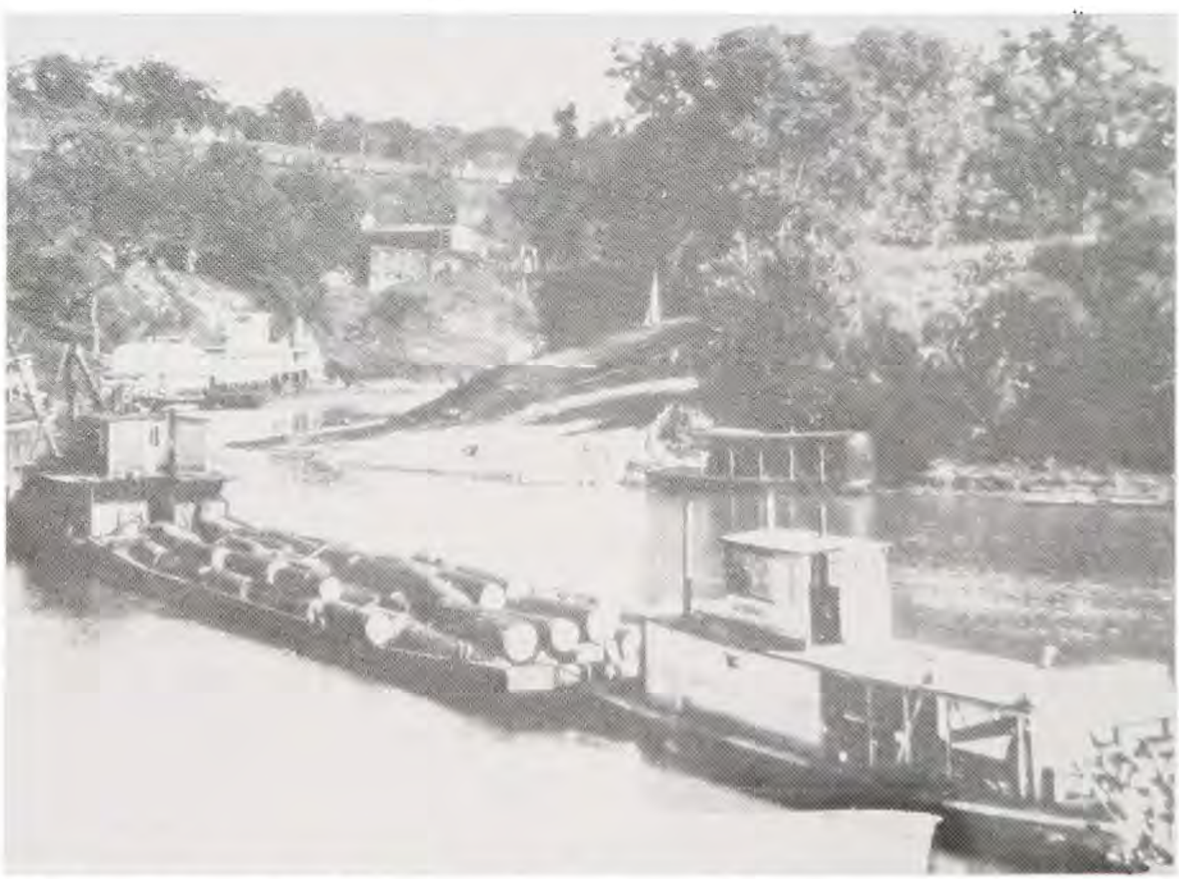
The Chattanooga District had been re-established in 1895, and Major Dan C. Kingman, Chattanooga District Engineer (later Chief of Engineers, U. S. Army), took charge of the Nashville District in Captain Biddle's absence. But after hostilities were terminated, a new District Engineer, Lieutenant Colonel Milton B. Adams, reported to Nashville. He had served briefly in the twin valleys in 1870 under General Godfrey Weitzel; hence, he had more knowledge about the situation than the ordinary Engineer officer. Nevertheless, he became the most controversial District Engineer in Nashville's history.[34]

Lock and Dam A below Nashville and Locks and Dams Nos. 1-7 above were nearing completion at the turn of the century, but the traffic which they were intended to aid was dwindling. Though a few barges of coal continued to wend down the serpentine Cumberland every year, coal boating on the Upper Cumberland had for all practical purposes ceased. A great deal of hardwood was sawed into lumber on the Upper Cumberland and shipped to Nashville by steamboat before 1885, and after that date, as timber most accessible to steamboats was cut, an extensive log-rafting traffic

developed, running out of Obey River, Caney Fork, and most other tributaries, and floating downstream to the sawmills at Nashville. During spring rises, millions of board-feet in logs were to be seen tied to the banks above Nashville, while the upper river thronged with log-rafts, usually manned by a crew of five men who worked sweeps at the head and stern of the raft to bend it around the horseshoe curves of the Cumberland.[35]

Logs came from all the upper tributaries, even dropping over Cumberland Falls, and provided an important source of hard cash for the mountaineers. A typical raft might come from Boatland in Fentress County, Tennessee, down the Obey River into the Cumberland and on to Nashville where the rafts were sold to the mills. Cordell Hull, the Tennessee statesman and ardent advocate of the improvement of the Cumberland, boasted often of the many times he had steered log-rafts down the Cumberland. Nashville was one of the hardwood centers of the world for a few years, but shortly after the turn of the century the high quality timber was gone. Staves of white-oak cut on the Cumberland furnished the wood for wine and oil casks in Spain, and old cedar rail fences, many built by Tennessee and Kentucky pioneers, were torn down to furnish the world's principal supply of wooden pencils about 1910, but the boom days of log-rafting were over by 1915.[36]

Because commerce on the Upper Cumberland was languishing, Lieutenant Colonel Adams concluded that canalization of the river above Lock and Dam No. 7 should be abandoned until commerce revived, and all funds devoted to the completion of the project below Nashville (Locks and Dams B to F). He



The *J. S. Dunbar* with a tow of logs at Burnside, Kentucky. On the right in the background is the *Rowena;* boat on the left may be the *Celina No. 2*

Jack Custer Photo Collection

could see no reason for completing the project above Carthage, Tennessee, "except mainly for the purpose of reaching coal fields alleged to be there," and reasoned the opening of the river from Nashville to the Ohio would be worth several railroads, for one of which (Tennessee Central) the people of Nashville had taxed themselves a million dollars. Boldly, he wrote Chief of Engineers George L. Gillespie (a native of Tennessee and Medal of Honor winner) that "the fact of the matter is that the way Congress appropriates for this river may be likened to childs play. For if it is really the intention to canalize the river and to derive benefits from the improvement the work should be concentrated on the lower river. . . ."[37]

An immediate uproar ensued: the Cumberland River Commission condemned Colonel Adams's report as "whimsical" and the Retail Merchants' Association of Nashville demanded the Colonel's removal. The chorus of complaints resulted in the convening of a Board of Engineers in Nashville to consider the canalization project's future, and Cordell Hull, among many others, appeared before the Board to state that nothing could be more disastrous to the Cumberland Valley than the abandonment of the canalization project. But, in spite of Hull's most earnest entreaties, the Board's decision was unfavorable and the construction of all locks and dams above No. 7 at Carthage, with the exception of No. 21 at Burnside, was suspended.[38]

Lock and Dam No. 21 was an anomaly, separated by a considerable distance from the remainder of the project lower down the river. Its construction was authorized in 1905 to provide a pool for loading barges, which could then float down to Carthage and Nashville on the crest of a rise, and apparently with the idea that the canalization project might eventually be constructed by working from both ends. For two seasons Lock No. 21 was constructed by a contractor, who lost $100,000 and the contract, and in 1908 the District Engineer, Major William W. Harts, ordered that the hired labor system be adopted to complete construction.[39]

Lock 21 on the Cumberland River at Burnside, Kentucky, as it looked on July 1, 1913.

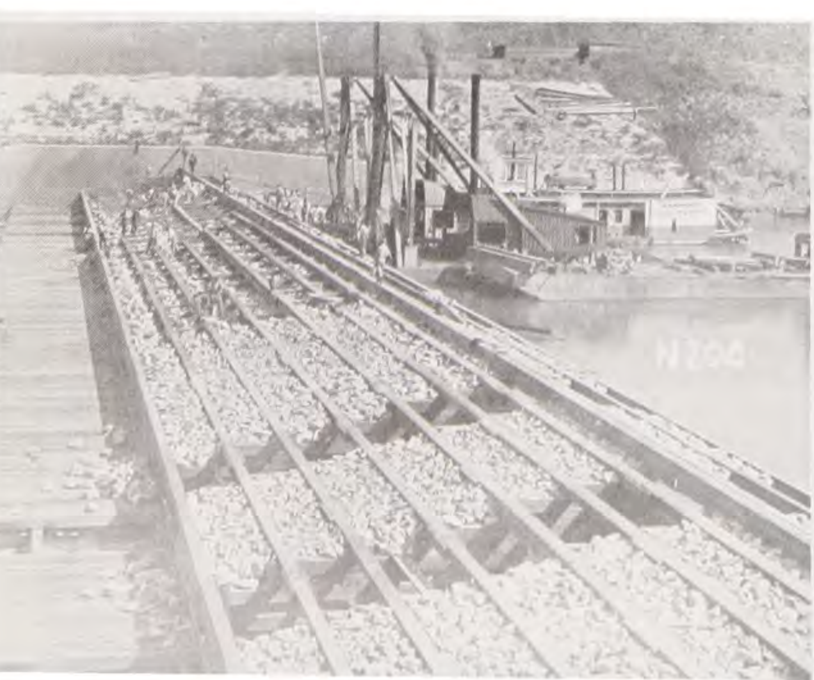
Major Harts chose John S. Butler to supervise the completion of No. 21, and Butler accomplished the job at near the original contract prices. Butler was a Tennessean, graduate engineer of Vanderbilt University, and an employee of the Nashville District from 1894 to 1917. During the First World War, he served as a Major in the Engineer Reserves, and after the armistice he was commissioned in the Corps of Engineers. He directed the construction of the powerhouse at Wilson Dam on the Tennessee, fortifications in Panama, and preparation of the important "308 Report" on the Upper Columbia River, the latter as District Engineer at Seattle.[40]

Besides men like John S. Walker and John S. Butler, the Cumberland River canalization project was directed by some exceptionally capable District Engineers—officers like Edgar Jadwin, Julian Schley, and Lytle Brown, all of whom later served as Chief of Engineers, United States Army, plus colorful officers like Harry Burgess, Jarvis Bain, C. A. F. "Sioux" Flagler, Harold C. Fiske, and Lewis H. Watkins. Of all of them, Major William W. Harts appears to have left the most vivid impressions on the memories of District employees.

Major Harts came to Nashville from an assignment in Paris. Purchasing a home on the western edge of Nashville, he commuted to the Engineer Office in a carriage behind a span of shining black horses which were groomed until they glistened. He always arrived late and strode through the staff offices in ramrod military gait, checking for tardy employees and forbidden magazines,

Lock D at Fort Donelson under construction in December 1913. The contractor for Lock D was Foster & Creighton Company, founded by Major Wilbur F. Foster, who had laid out Fort Donelson in 1861.

Excavating lockpit of Lock C, Cumberland River, on July 9, 1914. A steam locomotive crane had replaced mules and stiff-leg derricks for raising heavy loads by 1914.



Construction of Lock and Dam B, Cumberland River, October 14, 1916. Engineer towboat *Henry* in background.

running his finger over the tops of cabinets in search of dust, and sniffing for telltale signs of smoking. Aloof, professional, a voluminous writer on waterways development, he required District personnel to publish the results of their own investigations and experiences. During other phases of his career, he served in the Philippines, was construction engineer on the Lincoln Memorial in Washington, served as military aide to President Wilson, was Commandant of the Engineer School, and went with the AEF to France during World War I [41]

After Lock No. 21 had been completed, the sum of $85,000 was still necessary to construct the dam and other facilities, and Major Harts, with characteristic independence, reported he was skeptical of expending this additional sum, for in his opinion Lock and Dam No. 21 was largely in the railroad's interest. He discovered the Burnside and Burkesville Transportation Company had entered into an agreement with the railroad that freight would be handled by their boats exclusively; hence, said Major Harts, the completion of No. 21 would foster a monopoly which was distinctly "not in the public interest." He recommended that further appropriations be made contingent upon the provision of a public landing for boats by the municipality of Burnside, because the railroad owned all the water frontage.

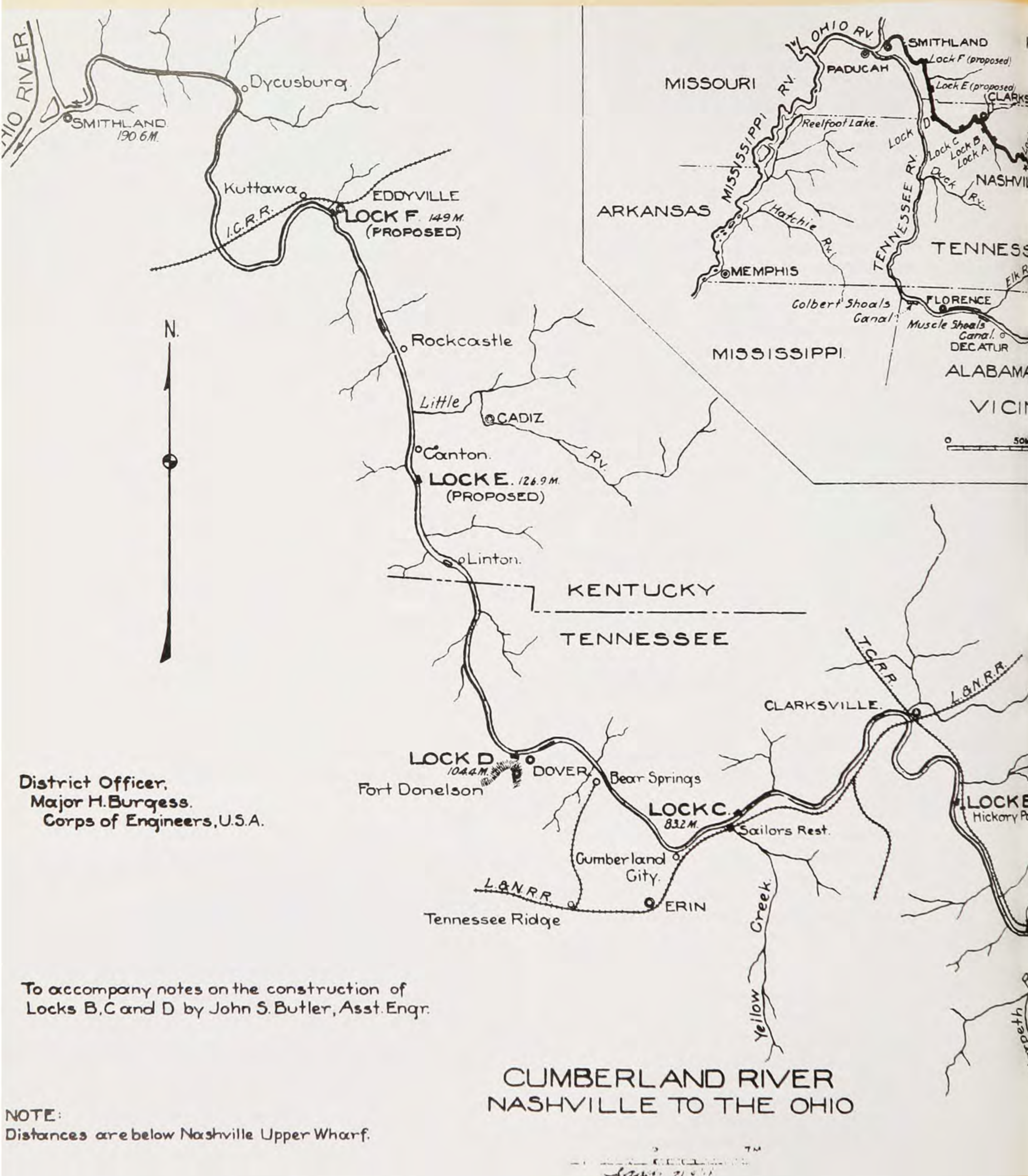
Congress accepted the Major's views in the matter and required that such a landing be furnished in 1910, and it was only after compliance with this requirement that the dam at No. 21 was constructed. The dam was the only one in the canalization project built of concrete. It should be added that large stones, amounting to about twenty per cent of the dam's volume, were embedded in the mass of the dam to lower costs and increase the unit weight of the concrete.[42]

There was still hope the section of the canalization project between No. 7 at Carthage and No. 21 at Burnside would be completed, and in 1913 the Cumberland River Improvement Association collected its own statistics on the commercial traffic on that river section, claiming, perhaps correctly, that at least half of the traffic went unreported, or was kept purposely small to conceal the amount of business done. The Board of Engineers for Rivers and Harbors was sufficiently impressed by the new statistics to order further investigation.[43]

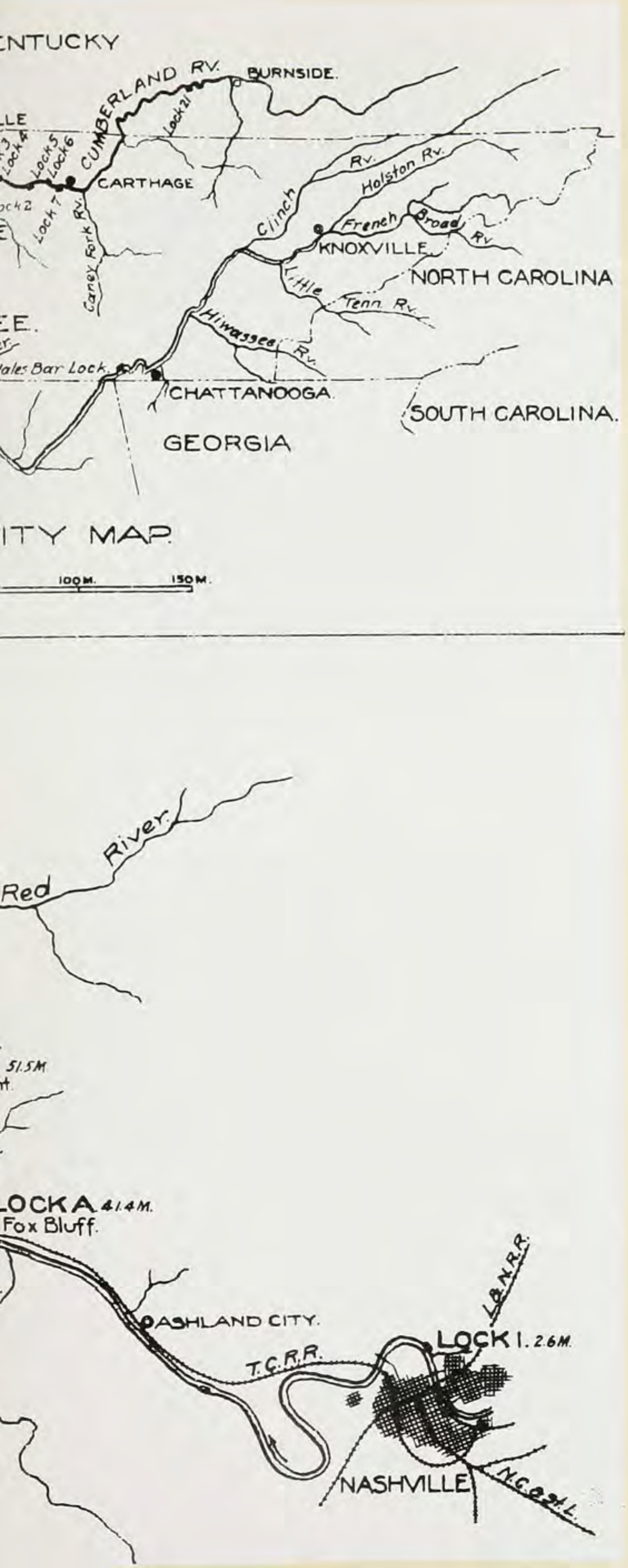
The District Engineer, Major Harry Burgess, found that an increased lock-lift would decrease the number of locks and dams necessary to canalize the river between No. 7 and No. 21 from thirteen to ten; he also discovered the commercial statistics collected informally by the Cumberland River Improvement Association were generally correct. Therefore, he reported favorably on the renewal of work on that section of the project, but, because claims for flowage damages at Lock and Dam No. 21 had been exorbitant, he recommended that any appropriations for the Upper Cumberland Project be made contingent upon the assumption of the payment of flowage damages by local, county, or state government.[44]

In spite of vigorous protests from Congressman Cordell Hull, Senator Ollie M. James, and others against requiring local cooperation for a project in the national interest, the Board of Engineers for Rivers and Harbors concurred with the District Engineer's recommendations. The Federal appropriation of 1919 for renewing construction of the canalization project between Locks and Dams Nos. 7 and 21 was made contingent upon the payment of flowage damages and the provision of suitable waterway terminals

Lock 7, Cumberland River, on September 28, 1914. The District was raising the walls of the lock three feet at this time.



1916 map of lock and dams sites on Lower Cumberland River.

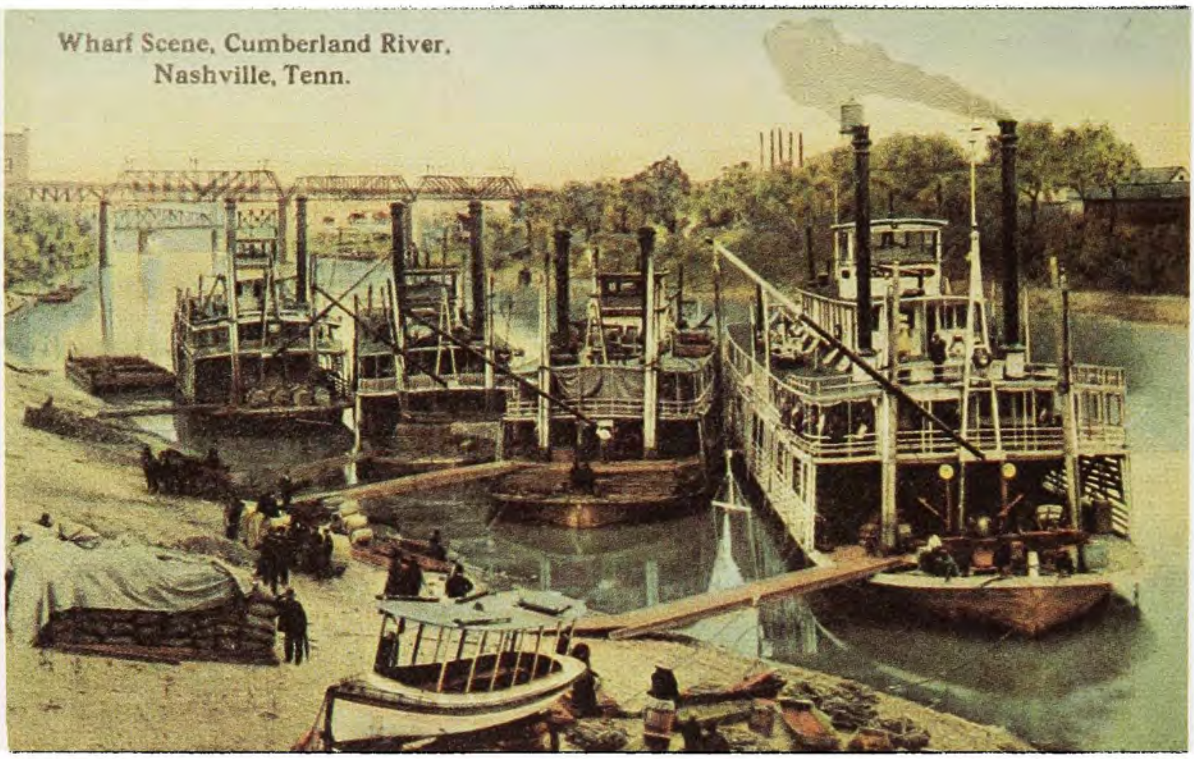


by agencies other than the United States. The counties bordering the river complied with the requirements, Tennessee counties in 1919 and Kentucky counties in 1923, and the construction of Lock and Dam No. 8 began in 1920.[45]

But Lock and Dam No. 8 was to be the last constructed in the Cumberland River Canalization Project, for river commerce continued to languish, while other uses for water resources, which would require multipurpose development, were becoming increasingly important. Explanations for the decline of river commerce conflict. One authority asserted that waterways traffic above Nashville ended suddenly about 1920, because of competition from trucks and motor vehicles on the new highway system then under construction. But Engineers in the Nashville District were certain that railroads were the greatest reason for the decline. One accused the railroads of conspiring against water shippers, declaring that "on nearly every important water front the greater portion of the available area for handling water traffic is occupied by railways. That this is accidental can scarcely be believed." It was his opinion that railroads were deliberately throttling through-freight business on the Cumberland by discriminations against river commerce, by purchasing control of river boats, and by seizing the water fronts. Whatever the cause, decreasing commerce led to a decision in 1923 to hold further construction on the Cumberland River Canalization Project in abeyance, pending completion of reports on multipurpose development.[46]

The last of the fifteen locks and dams built on the Cumberland for the benefit of navigation alone was completed in 1924, and in 1928, with the completion of Dam No. 52, Ohio River (which assured the required navigable depth below Lock and Dam F on the Lower Cumberland), a six-foot minimum project depth was established. But the steamboats, for which the canalization project had been designed, were disappearing.

The last commercially-operated steamboats on the Cumberland, the *Burnside*, the *Celina*, and the *Rowena*, which had eked out a business on the upper river, were taken out of the trade in



Jack Custer Photo

Steamboat commerce at the Nashville wharf.

Capping the timber-crib Dam No. 8, Cumberland River, about 1921.

Nashville District fleet at Lock F, Cumberland River, at Eddyville, Ky. Towboats *Hiwassee* and *John* and dredge *Kentucky.* Kentucky State Prison in background.

1933. But as the elegant steam packets left the river the sleek gasoline towboats, forebears of the modern diesels, were beginning to enter the Cumberland trade, pushing strings of steel barges before them. The new boats found many obstacles on the Cumberland, however, for the Cumberland, with a six-foot project depth, was like a narrow-gauge railroad connected to a standard-gauge, the Ohio with a nine-foot depth.[47]

In summary, the canalization of the Cumberland was originally planned during the halcyon days of the steamboats when there were few railroads serving the valley. Year after year, railroads expanded their lines and services and became more efficient, while steamboats made little progress towards decreasing the size of their crews, increasing their payloads, or consolidating their operations to facilitate interchange of freight. Meanwhile, the canalization of the Cumberland was prolonged for forty years by piecemeal appropriations, so meager that canalization was never completed. Still, it is amazing that so much was accomplished in spite of dilatory funding policies. One authority declared that if the shortcomings of Federal funding policies during this period had been as negligible as those of the Engineer Department, rivers and harbors bills would never have received the "pork barrel" designation which was applied to them.[48]

As the canalization project came to an end a new era was dawning: in 1921 the Federal Power Commission sent the Nashville District an application from a private company for a license to construct a high-head, storage, hydroelectric dam on the Cumberland above Nashville. The District Engineer rejected the application because the company did not have resources adequate to undertake such a development, but he reported that such a project was indeed feasible and requested permission to conduct further investigations. These investigations eventually culminated in the modern multipurpose development of the Cumberland River and its tributaries.[49]

CHAPTER IX

WHERE THE NIGHTS ARE ILLUMINATED

A radiant new light began to flicker bright in the twin valleys as the twentieth century began. The prophet of this new brilliance, Thomas A. Edison, in expounding his gospel, declared to the world that "where the nights are illuminated, you see new buildings, busy factories, clever and effective people. Where there is no cheap and effective artificial light you find stupid people." Electricity, he sermonized, "is the perfect light. It brightens people up."[1]

What made Edison's magic lamp even more wondrous was the fact that it could be economically powered by falling water, if the correct engineering procedures were applied. And this was what intrigued the people of the Tennessee Valley, who realized that potential electric power was flowing wasted through the gorge below Chattanooga, dashing uselessly across the reefs of Muscle Shoals, and roaring prodigally in floods which inundated the very homes which might have been brightened.

The first man to express the new hope of the valley people, by sponsoring legislation in Congress to open the way to hydroelectric power development on the Tennessee, was "Fighting Joe" Wheeler of Alabama. Just before Wheeler went to Cuba in 1898, where he is said to have confused the Spanish with the "damn Yankees" on occasion, he introduced a bill to extend to a private company the privilege of developing the wasted water at Muscle Shoals. His bill initiated the intricate and controversial history of the Muscle Shoals development, an issue which had nation-shaking repercussions. But a power project was not undertaken at Muscle Shoals until the exigencies of war led to the construction of the world's largest dam, Wilson Dam, by the Army Engineers. The first hydroelectric power project on the mainstream of the Tennessee was, instead, up river at Hales Bar.[2]

The Hales Bar project originated in a plan devised by the Engineers in 1900 to conquer their old Nemesis, the Suck below Chattanooga. District Engineer Dan C. Kingman investigated the navigational problems of this "formidable pass" and concluded that no further benefits could be gained by channel clearance methods—construction of a lock and dam, as Colonel Stephen H. Long had advised before the Civil War, was imperative. Scott's Point, about seventeen miles below Chattanooga, was selected as the most economical location for a navigation dam, but Major Kingman privately expressed his doubt that it would ever be built, by congressional appropriations, to Josephus C. Guild. Mr. Guild associated himself with Charles E. James in a company which agreed to undertake construction of a dam below the Suck in exchange for the rights to the electric power which would be thereby created.[3]

Congress first granted the right to construct the dam at Scott's Point to the City of Chattanooga in 1904, but when the city did not take advantage of this opportunity the Secretary of War authorized Guild and James to undertake the project. The contract with the Guild and James company, the Chattanooga and Tennessee River Power Company, provided the United States should pay the costs of the lock apparatus and the company the costs of the dam, the

Hales Bar Lock, Dam, and Powerhouse, Tennessee River.

company receiving in exchange the power produced by the dam for a period of ninety-nine years. The Scott's Point site had been first selected because it was the most economical location for a navigation-only dam, but the addition of power production as a purpose of the project necessitated a change in planning; the company requested that a new site be located downstream from Scott's Point in order that a higher-head might be obtained for the generation of power.[4]

Downstream sites were examined by dredging the channel and driving steel rods to rock—core borings were not in general use in 1905—and a site at Hales Bar, about thirty-three miles below Chattanooga, was selected. Hales Bar Dam was a pioneer work, for the effect of high dams, where both the improvement of navigation and the development of hydroelectric power were planned, was still uncertain in 1905, as also were the engineering techniques involved in such a project.[5]

Construction at Hales Bar was initiated in October, 1905, by William J. Oliver, a subcontractor, who speedily collected a great deal of plant and employed an army of men. Camps for the workers were established on both sides of the river and a miniature town was built, with stores, a bakery, an ice plant, a school, and entertainment centers such as a boxing club, a vaudeville hall, and pool-rooms. Even a hotel was constructed for the convenience of visitors.[6]

Progress at the project was slow, however—no concrete was placed anywhere in the river bed before 1908—and Oliver's connection with the job was terminated. (It was said that he made a million and got out.) Wilson and Baillie Company took over construction and completed it after another five years of work. The cost of the project was astronomical for the time. The company admitted a cost of over six million dollars, but knowledgeable engineers estimated it at about double the pub-

Work atop the caissons inside the cofferdam at Hales Bar Dam.

One of the leaks encountered during construction of Hales Bar Dam, Tennessee River.

Repairs underway inside Hales Bar Lock about 1945.

licized figure and it was common gossip among those associated with the project that "at Hales Bar they spent money like a drunken sailor."[7]

The Engineers inspected construction, but at that time the number of officers in the Corps was insufficient to meet the needs of the civil works program. A single officer had charge of the development of both the Tennessee and Cumberland, with headquarters in Nashville. In 1911, Chattanoogans began a campaign to get the Chattanooga District its own Engineer officer and flooded the Office of the Chief of Engineers with telegrams and petitions, but the best the Chief could do was to assign a junior officer, Captain William H. Rose, to Chattanooga under the orders of the Nashville District Engineer. Captain Rose was unable to remain at Hales Bar for long, however, for General George Goethals made special request for his services in Panama in 1912.[8]

Captain Richard C. Moore then reported to Chattanooga, but when he also was reassigned in 1913 the citizens of Chattanooga and the Hales Bar interests flooded Congress, the Secretary of War, and the Chief of Engineers with protests. It was the only occasion in the Nashville-Chattanooga District's history of public opinion influencing an Engineer officer's removal or retention at his post. Captain Moore's transfer was deferred until the closure of Hales Bar Dam by the direct verbal orders of the Secretary of War to a most reluctant Chief of Engineers; but the Secretary of War informed the power company at Chattanooga that when the dam was completed "Moore will go and not later." It must be admitted that the Hales Bar interests had some justification for their protests, because the rapid turnover in Engineer officers at the project resulted in a regrettable breakdown in the continuity of inspection at the project.[9]

As constructed, the dam at Hales Bar was about 1200 feet long and averaged 52 feet in height, with the power house located on the left bank and the lock on the right. The record for the highest-lift lock, first brought to the District by General George Goethals at Riverton Lock in 1891, was returned to the District by the 39-foot lift designed for the lock at Hales Bar. The first boat locked through Hales Bar on November 1, 1913, finally conquering the navigational problems of the Suck which had plagued navigation on the Tennessee since the Donelson party lost boats there in 1780, but Hales Bar Dam itself became a problem, taking on a fifty-year parade of engineers and beating them every time.[10]

Construction of Hales Bar Dam on the Tennessee River was interrupted by high water on March 16, 1913.

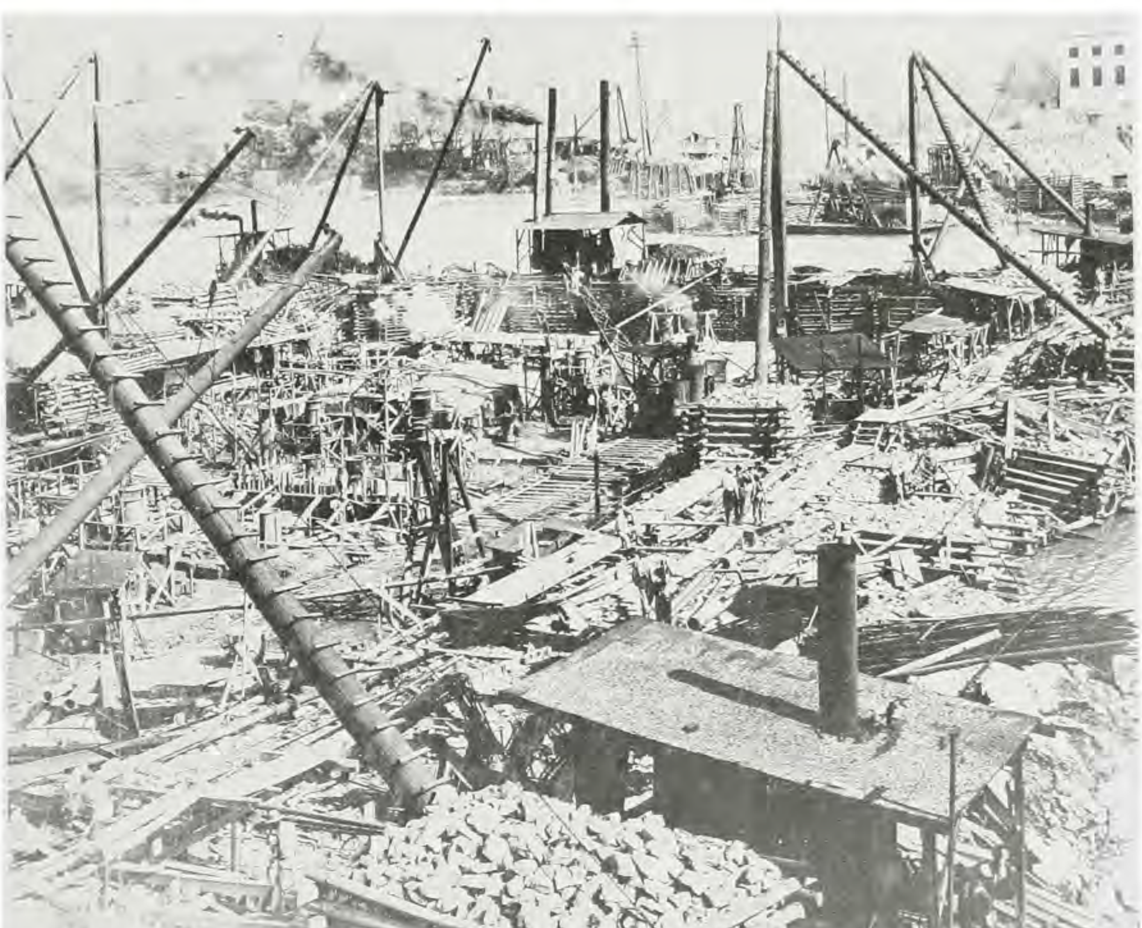
Under the terms of the contract with the company, construction was to be inspected by the Army Engineers, who were to direct the stepping of the concrete into rock to prevent slippage of the dam. All seams encountered in the foundation were to be cleaned and filled with concrete by the company, but it was not until 1910 that the first core drillings were made at the dam site, and what they revealed was shocking to Charles H. Tisdale, resident engineer. He immediately called in the Acting District Engineer, Major Edgar Jadwin, and Jadwin, too, was upset by the clay seams in the foundation. Water was already spurting into the coffer dams, but the contractors maintained it came from underground sources and not from the river above the dam. Major Jadwin was trans-

ferred (routinely) out of the District shortly thereafter and the company's view prevailed.[11]

To solve the difficulty, concrete pneumatic caissons, similar to those used to tunnel under rivers and to secure bridge pier foundations, were sunk through the crevised limestone foundation until it was believed that solid rock had been reached. The caissons sunk at Hales Bar—the largest was seventy feet square—covered a larger area than had ever been attempted before, but they did not begin to solve the problem and the acceptance of the dam by the United States was delayed pending further treatment of the leaks.[12]

Potassium permanganate dropped into the river above the dam appeared below, exploding the company's underground source theory, and the company began to take steps to locate and stop the leaks. Cinders, sand, rocks, and clay were dumped into the river at the suspected leaks. Nothing happened. In 1915, baled hay, rags, chicken wire, and other miscellaneous junk was dumped in, with no apparent results. The company even located a considerable supply of surplus ladies' corsets and heaved them into the river, which did not stop the leaks but may have left them in better shape.[13]

Efforts to plug the percolations were spurred on by a disaster which occurred at Austin Dam in 1911 when the dam broke because of foundation weakness and blotted out seventy-five lives. The company drilled holes at Hales Bar and 100,000 bags of cement were forced under the dam, by a process called grouting, and hot asphalt was pumped



Log crib cofferdams, stiff-leg derricks, and steam engines made working at the Hales Bar Dam project extremely hazardous.

down; neither resulted in more than a temporary check to the leaks.[14]

The persistent leakage at Hales Bar became affectionately known to geologists as the "greatest object lesson that the history of engineering foundations has to offer." Those who worked at the site had other more pungent names for them. The leaks were the subject in 1929 of the first symposium held in the United States on the subject "Geology and Engineering for Dams and Reservoirs." The consensus of opinion among geologists was that since the entire river bed in the section below Chattanooga was underlaid by crevised and clay-seamed Bangor limestone no better site could have been found—the problem was simply the lack of understanding by the pioneer engineers at Hales Bar of the techniques of exploring and treating such a foundation. Dams have since been built on similar foundations with no serious leakage problems, because modern engineering methods were applied, but the leaks at Hales Bar were never completely plugged and the dam was never accepted by the United States, the Engineers' view being that it would be more of a liability than an asset.[15]

The Tennessee Valley Authority acquired the dam in 1939 when it purchased the facilities of the Tennessee Electric Power Company, and it reconstructed Hales Bar Dam about 1950, raising it and installing a concrete wall on the upstream face. But the leakage persisted and the Authority eventually solved the problem by replacing the old dam with another (Nickajack) a few miles downstream.[16]

Modern construction sites are less cluttered than was that of Hales Bar Dam, but are still hazardous.

While Hales Bar Dam was rising near Chattanooga, downstream at Muscle Shoals a heated controversy over the rights to develop the extensive hydroelectric power potential there was delaying progress. From 1898, when General Wheeler introduced the first bill for the development of the Shoals, until 1916 there were a series of proposals and counter-proposals, surveys, detailed surveys, and highly-detailed surveys. The position of the Army Engineers on the most important issue—whether the United States should, as it had at Hales Bar, join in a cooperative public-private development—gradually shifted from skepticism to qualified support.

In 1909, a special Board of Engineers appointed to study the Muscle Shoals question concluded that "any partnership relation between the United States and a private corporation is necessarily to be closely scrutinized as the results in the past have been that the Government, as a party to such agreements, has usually suffered thereby." The Board added, however, that the views of the people of the nation were in transistion and that in the future the demand might arise for the utilization of water power, "even if it should require a new departure in governmental policy."[17]

General Dan C. Kingman, Chief of Engineers, who had supported the arrangement at Hales Bar with the Guild-James company a decade before, approved of a cooperative public-private plan for the development of Muscle Shoals in the interest both of navigational improvement and power production in 1914, but the conflict in Congress over such cooperation prevented the implementation of such a plan and another survey was ordered. The direction of the survey fell to Nashville District Engineer Harry Burgess, a native of Mississippi who later served as Commandant of the Engineer School and as Governor of the Panama Canal Zone. Major Burgess determined to put an end to the endless surveying which, it seemed, Congress had seized upon as a form of "buck-passing." "It would seem wise," said the Major, "to make the report on this survey a final report on this proposed improvement, so that Congress need not ask for further data." He and the District staff proceeded to do just that, creating a report which ran to nearly 400 pages in manuscript and which contained nearly complete specifications for any alternative plan of development at Muscle Shoals.[18]

The Burgess Report of 1916 was the largest of its kind ever prepared at the date it was published; it even included plans for laborers' camps and directions for fencing them to keep out "bootleggers, dope peddlers, agents for shyster lawyers, loan sharks, and other predacious camp followers." The Burgess Report supported cooperation with private interests to get the project underway, but the Chief of Engineers suspended any further action, noting that Section 124 of the National Defense Act of 1916 had changed the situation, because it called for the construction in the United States of nitrate plants and Muscle Shoals was one of the sites under consideration.[19]

The Burgess Report became the basis for the development of Muscle Shoals; all three of the dams, numbered one to three proceeding upstream, planned in the Burgess Report were eventually constructed. Dam No. 2, the first constructed, was given the name of the President and became Wilson Dam; Dam No. 1, a navigation dam just below Wilson Dam was constructed in 1925; and Dam No. 3, Wheeler Dam, was begun in 1933 by the Engineers and completed by the Tennessee Valley Authority.

In the fall of 1917, President Woodrow Wilson selected Sheffield, Alabama, and Muscle Shoals, as the site of two plants to produce nitrates for munitions, replacing foreign sources. One of the plants was operated successfully near the end of the war, but the other proved a failure. The two plants were constructed by agencies other than the Corps of Engineers, but the Corps was ordered to proceed with construction of Dam and Power House No. 2 at Muscle Shoals to furnish hydroelectric power for nitrate production.[20]

On April 1, 1918, a special Engineer District was created at Florence near the Wilson Dam site to handle the administrative problems which construction of the largest dam in the world would

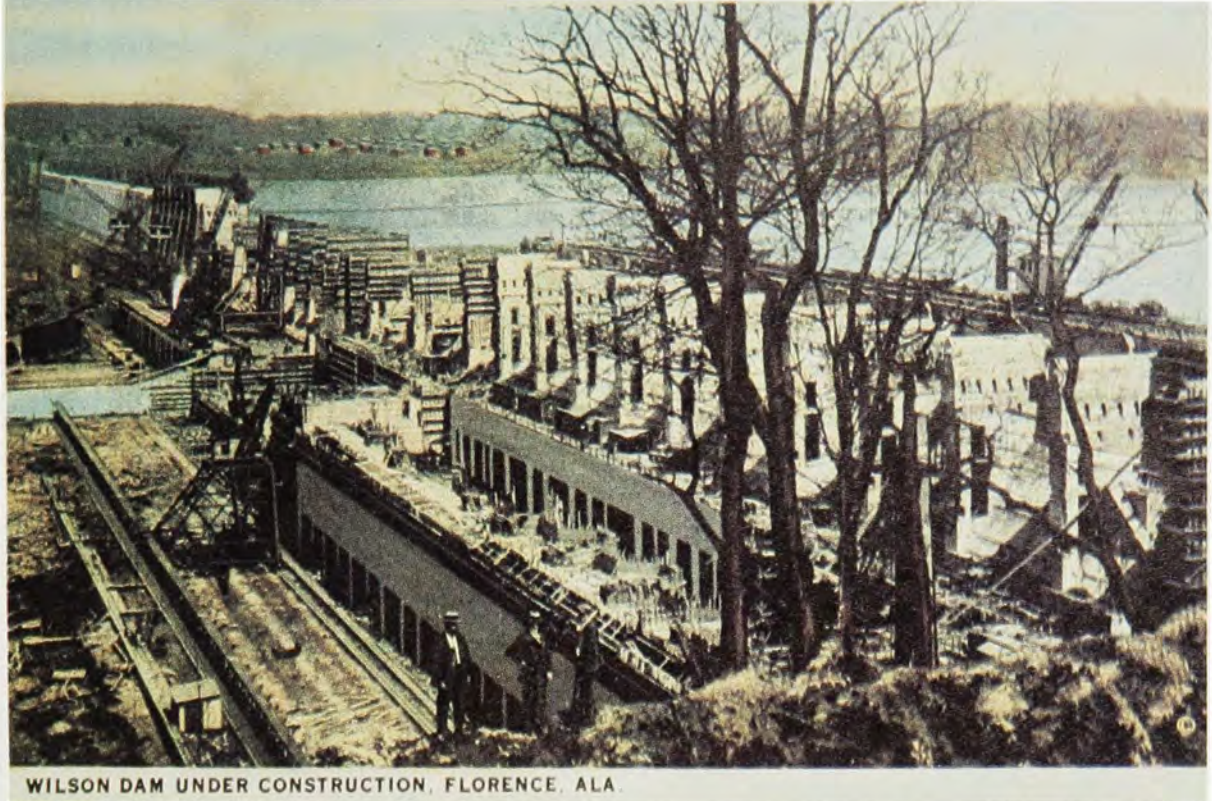
Engineer drillboats were exploring the foundation of Wilson Dam in this 1916 picture.

create, and Colonel Hugh L. Cooper, National Army, was appointed District Engineer. Colonel Cooper was selected because of his international reputation as a hydroelectric engineer prior to the war, but his stay at Florence was short because General Pershing requested his services in France. After the war, the Engineer Department employed him as Consulting Engineer at the Wilson Dam project until the power features of the project were essentially complete. In 1926 he accepted a contract with the Soviet Union to design an 800,000 horse power project on the Dnieper River, and at his death in 1937 Colonel Cooper was consulting engineer for hydroelectric projects around the globe, notably the Assuan (Aswan) Dam on the Nile River.[21]

The working force and construction plant for the Muscle Shoals project were just being assembled when the War Industries Board ordered a work stoppage to conserve critical materials and man power, but operations resumed on November 9, 1918, just before the armistice, and concrete soon began to slide into the forms. General Lansing H. Beach, Chief of Engineers, directed much of the work through a series of District Engineers at Florence—Major D. A. Watt, Col. J. B. Cavanaugh, Lt. Col. Lytle Brown, Col. W. J. Barden, Lt. Col. George R. Spaulding, and Lt. Col. Max Tyler. Abnormal shortages of labor and materials forced the construction of Wilson Dam by hired day labor under the direction of the Engineers, and the work was urgently pressed with this force. One of the District Engineers revealed, after his retirement, that Wilson's Secretary of War, Newton Baker, told him to get the job moving, for if a Republican administration were elected in 1920 the project would never be completed. Subsequent events proved Baker to have been in error, but a political dispute did temporarily halt the project during the Harding administration.[22]

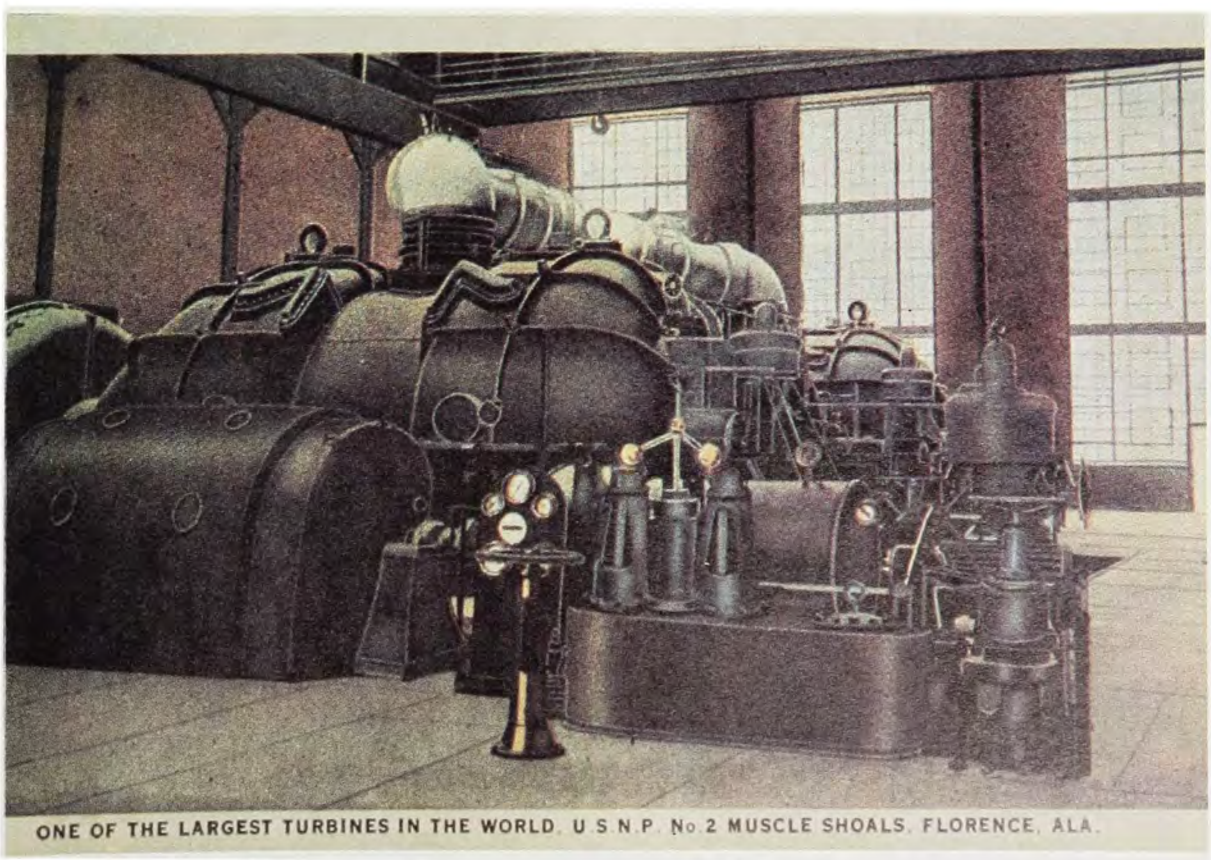
Congress refused in 1921 to appropriate further funds for the construction of Wilson Dam, after some $17,000,000 had been expended, chiefly because of opposition to Federal operation of the project. The Harding administration directed the Chief of Engineers to communicate with private power companies about leasing arrangements whereby the United States would receive a reasonable return on its investment, but the Chief found no interest in the project and was even informed he was wasting his "young life" in the quest. This situation was reversed after Henry Ford, the automobile magnate, took an interest in the project and visited the Tennessee Valley in company with Thomas Edison. Ford made a proposal for leasing the works at Muscle Shoals, which was followed by proposals from other companies, but all were eventually rejected by Congress and in 1922 another appropriation enabled renewal of construction at Wilson Dam.[23]

The workers, over 4,000 of them, swarmed back to the project site, commuting in special buses from neighboring towns, or moving to camps near the site. Two construction divisions were established to organize the work—Division No. 1 on the north side of the river for lock and dam construction and Division No. 2 on the south side for construction of the power house and



Jack Custer Photo Collection

Wilson Dam under construction.



Wilson Dam powered turbines for nitrate production

related structures. Joseph Wright (later Consultant Engineer at the Middlesboro, Kentucky, Flood Control Project and the W. P. A. projects on the Cumberland River) had charge of Division No. 1, and Major John S. Butler returned to the twin valleys from his military duties to take charge of Division No. 2. Other operating divisions at the Wilson Dam project were Engineering, Administration, and Supply. The latter division, directed by Major Stuart C. Godfrey, faced enormous problems because of war-time shortages, the postwar recession, and the fact that the dam site was a hundred miles from the nearest industrial center.[24]

One of the first problems the Supply Division encountered was a shortage of railroad cars to move cement to the site and meet the pouring schedule; the Division purchased seventy-five boxcars and put them into operation between the dam and the cement mills. The Jackson Island concrete mixing plant and cement warehouse at the dam site was destroyed by fire in 1920, but equipment was borrowed from the Ordnance Department's Old Hickory Powder Plant near Nashville and the big mixers were churning again in ninety days. Sand and gravel for concrete aggregate was dredged out of the river bed twelve miles below the dam, cleaned, screened, and towed up to the site for the giant mixers, supporting a production of 2,000 cubic yards of material per day. The sheer magnitude of the project is revealed by figures such as the 1,400,000 cubic yards of concrete poured, the 700,000 cubic yards of rock excavated, and such temporary features as 6,500 feet of timber-crib coffer dams, nearly 28 miles of railroad, and 5 miles of sewers.[25]

The fine spirit of camaraderie engendered by the struggle against the Tennessee was very important in view of the fact that many serious accidents gave the project some of the characteristics of combat engineering. Numerous devices were adopted to bolster morale and even poetry, of a rough variety, was marshalled to the cause. One example is an anonymous bit of doggerel entitled "The Service of Supply":

Down in the bed of the river,
  They're building the Wilson Dam.
"Boys, you have got to hustle!"
  Is the word from Uncle Sam.
In the Supply Division
  You bet we're making speed;
The road is rough, but we'll get the stuff
  To the boys—whatever they need.

If the railroads don't deliver it,
  We'll go and get the cars.
If the shops on earth don't keep it,
  By God! we'll buy from Mars!
Barge loads of sand and gravel,
  Six million sacks of cement,
Millions to spend 'fore the job will end,
  But to squander—not a cent!

You construction men who are working
  Down where the river flows,
Don't stop to look behind you,
  Ask—and what you say goes!
We'll help you "put it over,"
  We'll get behind and ram.
Make each blow tell—in spite of hell,
  Let's build the Wilson Dam.[26]

Administration of the gigantic project was another tough task, but despite the size of the project the District Engineer was burdened with an unconscionable number of picayune details in the interest of economy. As only one example, the District Engineer wrote the Chief of Engineers in 1925, requesting a decision on the vital matter of the disposition of

Memorial plaque at Wilson Dam, where 56 men lost their lives during construction.

napkins and tablecloths at the project. He desired to convert them into dishcloths when they became unserviceable for table use. The Division Engineer approved the District Engineer's proposal and passed it on to the Chief of Engineers who authorized the conversion of tablecloths to dishcloths, if the tablecloth account were debited and the dishcloth account credited. No doubt a few cents were saved thereby, but it does seem unreasonable that the Engineer officers and their staffs were forced to correspond with each other about such matters.[27]

As the giant dam neared completion in 1925, the question of the disposition of the power to be generated arose. Heavier reinforced concrete penstocks and wheel chambers than were ever before constructed were installed at the dam, with eight main power units originally installed and space for ten more provided. Power generation began on a testing basis on September 12, 1925, and by June, 1926, six generators were operational, producing 60,226,100 kilowatt hours during the latter month, but the purchase of equipment for a high-tension switching yard, necessary if distant transmission were desirable, was held up pending a statement of policy by Congress. Since power generation began before any policy was established, the resulting current was delivered to the lines of the Alabama Power Company through transformers loaned by them for that purpose.[28]

Dam No. 1, a navigation dam 2.5 miles below Wilson Dam (Dam No. 2), was authorized on March 3, 1925, and was rapidly constructed, opening on November 1, 1925. It was only twenty feet high and 220 feet long, with the sole purpose of securing adequate navigational depth in the approach to Wilson Dam. With this and Wilson Dam completed, the only portion of the Muscle Shoals still to be conquered lay at the head of the pool created by Wilson Dam. Dam No. 3 (Wheeler) was planned for that site and an Engineer officer urged its rapid construction, because of the increasing power demands of the region and of the nitrate plants.[29]

The locks at Wilson Dam opened to commercial navigation on June 1, 1927, thus completing the project. (The Florence District continued its independent existence until June 1, 1928.) A bronze memorial tablet, paid for by voluntary contributions of employees at the project, was placed on the balustrade of the north approach to the dam. It read:

> In Memory Of The Men
> Who In Line Of Duty Sacrificed
> Their Lives For The
> Completion Of This Work[30]

Construction work is always dangerous and Wilson Dam was built before the Engineers and the construction industry in general became safety conscious. Danger lurks on every side at the site of a dam under construction, with coffer dams going up against a surging river, rock blasting thudding behind the coffers, and a dizzy swirl of men, trucks, and machinery swarming over the dam site while cranes swing heavy loads through the air. Wilson Dam claimed fifty-six lives, a very heavy toll. Truly, the magnificent arches of Wilson Dam were built not only of concrete but also of human sweat and blood.[31]

The size of Wilson Dam amazed and continues to amaze knowledgeable visitors. Only Assuan (Aswan) Dam on the Nile approached it in volume of concrete placement in 1925, and its big generators were capable of producing the equivalent of the power developed by burning two and a half million tons of coal per year. Indeed, the gargantuan dimensions of the dam may have inspired the creation of the Tennessee Valley Authority; at least Franklin Roosevelt so implied after a visit to the project in 1933:

> I was not only impressed with the size of the great operation at Muscle Shoals but I can tell you frankly that it was at least twice as big as I ever had any conception of it being.
>
> . . . .
>
> My friends, I determined on two things as a result of what I have seen today. The first is to put Muscle Shoals to work. The second is to make of Muscle Shoals a part of an even greater development that will take in all of that magnificent Tennessee River from the mountains of Virginia down to the Ohio and the Gulf.[32]

WILSON DAM, TENNESSEE RIVER
General view of work on Aux. Apron toe, North Channel from Jackson Island, July 26, 1926.

While the Engineers were making a giant step toward multipurpose development at Wilson Dam, they were also engaged, just upstream, in the construction of an ill-advised, timber-crib dam for the single purpose of navigation at Widows Bar. Understanding this anachronism is only possible if one traces the conflict among the Engineers over multipurpose development back to the administration of Theodore Roosevelt just after the turn of the century.

The first decade of the twentieth century was marked by a tremendous revival of interest in waterways development, partially engendered by President Theodore Roosevelt's enthusiasm for conservation of natural resources, partially by opposition to railroads, and partially by certain reforms in the rivers and harbors program. The Rivers and Harbors Committee of the House, under the chairmanship of Theodore Burton, reformed "pork barrel" spending and piecemeal waterway development by placing the program on the solid basis of engineering analysis. In 1907 completion of several major projects was funded and no new project was authorized unless the entire estimated cost of the project was available and unless the approval of the Corps of Engineers was fully evident.[33]

Theodore Roosevelt, in presenting the report of the Inland Waterways Commission of 1908 to Congress, expounded his ideas about water resource development to the nation: "The report rests throughout on the fundamental conception that every waterway should be made to serve the people as largely and in as many different ways as possible. It is poor business to develop a river for

Installing the Wilson Dam power generators, 1926.

navigation in such a way as to prevent its use for power, when by a little foresight it could be made to serve both purposes. . . ."[34]

Many waterways experts agreed with the President and the report of the Commission; on the other hand, there were those who were not only opposed, but felt that multipurpose development, although theoretically possible, was really impossible. Nashville District Engineer William W. Harts, for example, published a list of eight criticisms in 1909 of the high dams and storage reservoirs necessitated by multipurpose development:

1. They have been found inefficient and unsuccessful wherever tried.

2. Unsafe and attended with great risk, owing to the enormous dams required and quantities of water impounded.

3. Of doubtful legality, and a probable source of much litigation, owing to the infringement of riparian rights.

4. Enormously expensive compared with other methods.

5. Slow in construction to a useful stage.

6. Soon filled with sediment in many localities.

7. Not advocated by river engineers.

8. In operation, if they should be constructed, they would present a problem too stupendous and complex for successful operation.[35]

"It seems improbable," Major Harts predicted, "that it will ever be extensively used." Many Engineer officers were of Major Harts' persuasion: they thought multipurpose development impractica-

General William W. Harts, Nashville District Engineer, was decorated by Marshall Petain during the First World War.

ble because of numerous unsolved engineering problems and the great costs it would entail. As late as 1938, after the Engineers themselves had begun multipurpose development, cadets at West Point still read in their engineering text that costs of flood control were prohibitive and that while power generation could lower costs it was incompatible with flood control because "water-power requires a full reservoir and flood prevention requires an empty reservoir."[36]

As it happened, in the year that Major Harts published his objections to multipurpose development, Congress required that the development and utilization of water power for industrial and commercial uses be considered in all surveys by the Engineers. As demand for hydroelectric power increased and the number of dams constructed for both power and navigation grew—Hales Bar Dam and Wilson Dam among them—multipurpose development became not only feasible but necessary, and Congress created the Federal Power Commission, with authority to grant licenses for hydroelectric developments, in 1920. Thus, construction of Widows Bar Dam on the Tennessee for the benefit of navigation alone, between two combined power and navigation dams, was anachronistic.[37]

The Engineers proposed a high dam for both improvement of navigation and generation of power for the section of the Tennessee River between Hales Bar and Wilson Dams, to be constructed as a public-private project as had been done at Hales Bar, but no private companies were interested in the project and in 1916 the Engineer recommended two low navigation dams at Widows Bar and Bellefonte Island, with local interests to assume payment of flowage damages. The latter requirement was dropped after a heated public hearing on the subject in northern Alabama. District Engineer Walter S. Winn and Division Engineer Lansing H. Beach, later Chief of Engineers, represented the Engineer Department at the hearing, and General Beach came

Wilson Dam and powerhouse on Septembr 25, 1925. 280,000 horsepower electrical generators were installed in the powerhouse.

away in a rage. Mr. Winn recommended that no improvement on that river section be undertaken at all until after completion of the dams at Muscle Shoals—a wise recommendation which should have been accepted. General Beach, after caustically commenting on the "unprogressive class of people" he encountered at the public hearing, recommended that local cooperation requirements be waived and the construction of Widows Bar Dam proceed in spite of the objections of Mr. Winn and the citizens near the dam site.[38]

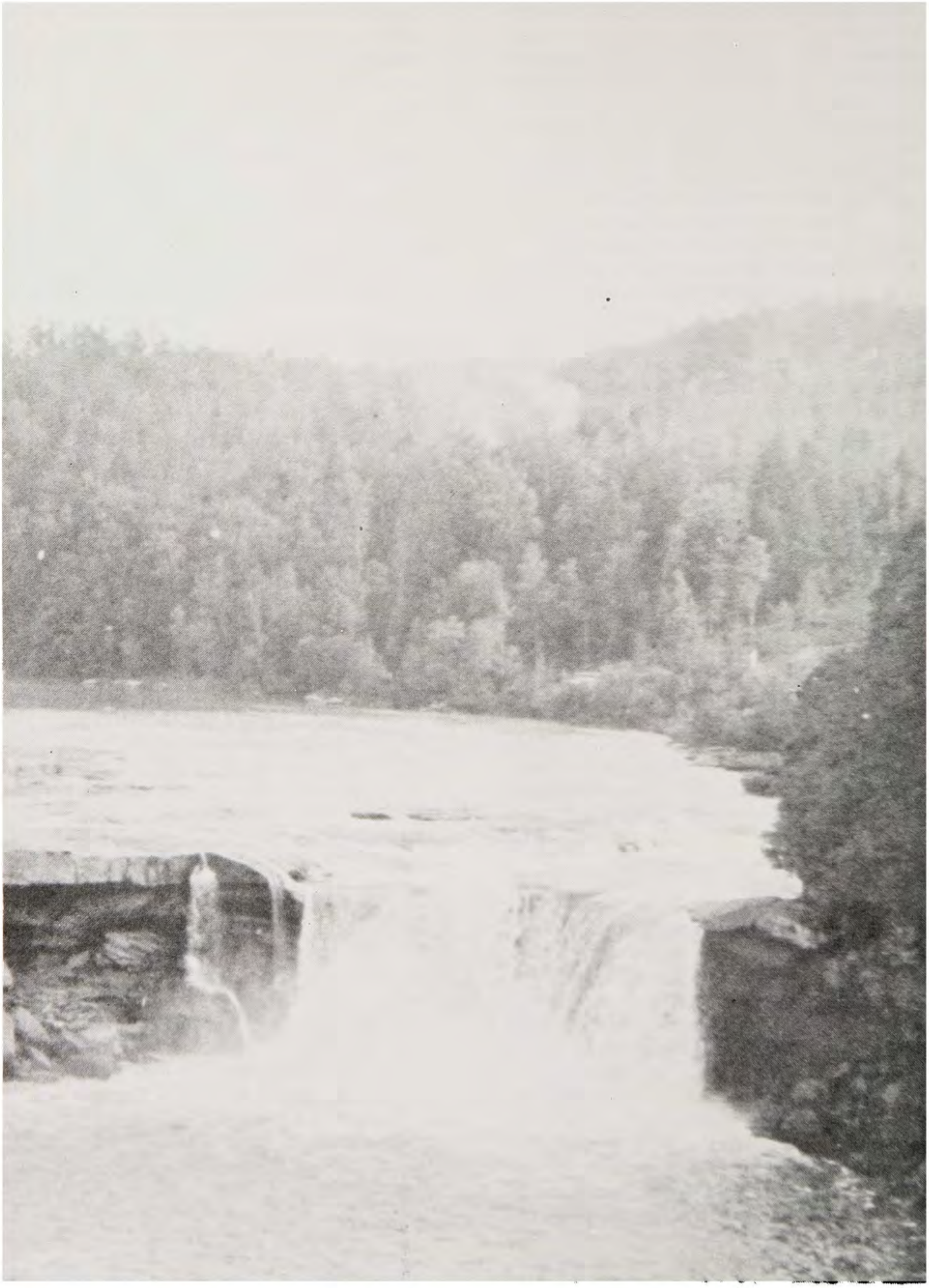
Congress accepted the General Beach's views on the matter in 1919, waived local cooperation requirements, and directed that Widows Bar Dam be constructed. The dam site was probed with steel rods, a few core drillings were made, and construction of Widows Bar Dam, a low, timber-crib, stone-filled, navigation dam, began; it would have taken four more of them to establish a six-foot minimum channel between Muscle Shoals and Hales Bar.[39]

Chattanooga District had charge of construction of Widows Bar Dam, which, after some delay because of high water, was completed on September 8, 1924, the lock opening to traffic in early October. Then, on November 7, an eighty-foot section of timber-cribs washed out. Repairs were rushed and were nearly completed when another unexpected rise in the river washed out a 200-foot section. Continuous high water made closure of the dam an extremely difficult affair, and the Chattanooga District Engineer proposed to fill three dump scows with rock and sink them in front of the gap to break the current while repairs were made. But the project was transferred to the Florence District, and Major Max C. Tyler investigated the dam site and found a clay pocket under it about 200 feet wide which the foundation probing and drilling had not revealed. The opinion was common in those days, however, that practically any foundation was suitable for a low, timber-crib dam, providing the sheet-piling on the upper face of the dam was driven to rock.[40]

Coffer dams were constructed across the break by the Florence District, steel sheet-piling was driven along the upper face of the dam across the clay seam, the wooden apron below the dam was replaced by one of concrete, and the dam was again opened to navigation on October 1, 1925. It remained in service, however, for only fourteen years—submerged by the pool of Guntersville Dam, a multipurpose project of the Tennessee Valley Authority, in 1939.[41]

Constructed in the face of local opposition and of an adverse recommendation by District Engineer Walter S. Winn, located between two high, power and navigation dams, built on an improper foundation, and erected while the survey of the Tennessee Basin for comprehensive development, upon which the Tennessee Valley Authority was to base its program, was in progress, Widows Bar Dam must be considered the most ill-advised project ever undertaken by the Army Engineers on the Tennessee River. On the other hand, when the Engineers built the dam there was no interest in cooperative construction for power development by a private company, nor did it appear that the United States would be interested in constructing another project like Wilson Dam, which was an anomaly originating as a defense project. Multipurpose development depended upon the support of the American people—support which no one save a prophet could have foreseen before 1933.

As it happened, the latter statement makes Widows Bar Dam even more unfortunate, for such a prophet was in charge of the Nashville and Chattanooga Districts while the dam was under construction. District Engineer Harold C. Fiske was perhaps the greatest proponent of multipurpose and comprehensive water resource development in the nation during the 1920's. He initiated the comprehensive "308 Report" on the Tennessee River Basin at least four years before they were authorized by Congress for all major river basins in the nation. Indeed, from an engineering standpoint, Major Fiske, rather than Senator George Norris, might deserve the sobriquet "Father of the Tennessee Valley Authority."



Cumberland Falls as they looked on May 25, 1924. River flow was 3,052 cfs at the time.

CHAPTER X

THE PARTING OF THE WAYS

A quiet revolution occurred in the Cumberland and Tennessee Valley during the half century preceding 1975. Its origins were in the comprehensive studies of the twin river basins conducted by Army Engineers during the decade following the First World War. These exhaustive reports blazed the trail for the multipurpose development of the twin rivers and their tributaries, but responsibility for the comprehensive development which ensued was divided—the twin waterways were parted.

Congress directed that comprehensive surveys and reports be prepared on the nation's rivers for multiple purposes—navigation, flood control, hydroelectric power generation, and related functions—and published estimates of the costs of developmental planning in House Document No. 308, 69th Congress, 1st Session, 1926. Hence, the comprehensive studies of the Cumberland and Tennessee watersheds are known as the "308 Reports," but the Nashville-Chattanooga District had comprehensive reports on the twin rivers well underway before their authorization for other major river basins in 1927.[1]

As the huge Wilson Dam began to rise across Muscle Shoals in 1920, a survey of the river above it was authorized. Major Harold C. Fiske, District Engineer, was instructed by Chief of Engineers Lansing H. Beach that studies of potential hydroelectric development, mineral and industrial resources, drainage problems, flood protection, and any other subject which might have a bearing on the future improvement of the Tennessee should be included in the study.[2]

Major Fiske was faced with the immediate challenge of producing minutely detailed maps of the Upper Tennessee Basin with funds so limited they could not begin to cover the costs of mapping methods previously in use. He enlisted the aid of the Army Air Service, commanded by a former Corps of Engineers officer, to experiment with aerial photography as a means of accomplishing topographical mapping at a reduced cost. Two aviators of the Army Air Service reported to Chattanooga and began the experiment in 1921, shooting photographs of the valley from a De Haviland airplane at an average altitude of 12,500 feet.[3]

Over 4,000 photographs were taken of the Tennessee Valley between Knoxville and Chattanooga from the flimsy aircraft, and maps were produced from a mosaic of the pictures, using a stereoscope to bring out the contours. Although aerial mapping had been performed before, no previous attempts had been accomplished methodically over any large area in the United States. The successful experiment on the Tennessee proved the value of aerial mapping and Major Fiske recommended that it be adopted nationally on similar surveys.[4]

When the preliminary report on the Upper Tennessee appeared, proposing coordination of the improvement of navigation with power production, flood peak reduction, and wider utilization of the mineral resources of the valley, hearty approval and skeptical criticism erupted from all sides. Critics vehemently declared the Corps of Engineers was not properly concerned with either power production or the abatement of flood damages. Navigation on the Tennessee was minor and industrial development was inconsequential, they

Low water on the Cumberland River at Clarksville on October 10, 1913. Teams and wagons were fording the river, driving across the ferry, and continuing to the opposite bank. The Clarksville gage read 0.5 feet on this day.

said. But Major Fiske was not to be cowed.[5]

"With a large quantity of cheap electric energy available," he reasoned, "these resources plus the minerals brought from a distance will make a large growth of industries of various kinds possible. Extensive industries indicate large shipments, and, if properly planned from the outset, much of this tonnage should move naturally over the rivers."[6]

The equally-outspoken Division Engineer, Colonel William W. Harts, formerly Nashville District Enqineer, mercilessly castigated Fiske's preliminary report on the Tennessee. It is, he said, "clearly an investigation into the water-power possibilities, mostly on the tributaries, with no explanation as to how it is expected that navigation will be benefited thereby." Colonel Harts recommended the survey be immediately curtailed.[7]

The Board of Engineers for Rivers and Harbors lavishly praised the report as interesting, unusual, exhaustive, and instructive, but, because Major Fiske proposed to continue a very expensive survey on a scale never before attempted, the Board concurred with the Division Engineer. The Chief of Engineers, General Lansing H. Beach, on the other hand, supported Major Fiske, finding that "the many and varied benefits which will necessarily follow the construction of dams on these waterways providing both power and navigation are so great in amount and so far-reaching in application that it is highly advisable as a matter of enlightened public policy to obtain at as early a date as possible the information which the proposed survey will develop."[8]

Congress found Major Fiske's and General Beach's arguments more persuasive and authorized continuation of the survey. It proceeded, following Major Fiske's line of reasoning: the construction of combined power-navigation dams on the main stream of the Tennessee and power-storage dams on the tributaries would provide flood control and economical hydroelectric power to entice industry, which would in turn utilize the river because of the economical transportation it provided. This concept became the foundation of

multipurpose development in the Tennessee River Valley.

Private power interests were fascinated by Major Fiske's reports on the Tennessee, and there was a corresponding surge of interest in the potential for power development on the Cumberland. Major Fiske and the Nashville District investigated several applications for dam sites on the Upper Cumberland, notably that of the Cumberland Hydro-Electric Power Company in 1923. This company applied for a license to construct two power dams on the Cumberland, at Burnside and Cumberland Falls, plus a third on the Big South Fork. Major Fiske and his staff studied the possibilities of these dams, noting that they would produce power, would augment the low-water flow on the river below Burnside (from 250 cfs to 3,300 cfs, he estimated), and could reduce the extreme flood crest on the capricious Cumberland by perhaps twenty feet. He requested, and received, authorization to proceed with a comprehensive survey of the Upper Cumberland, similar to the one already in progress on the Upper Tennessee, and suspended further planning for the old Cumberland River canalization project between Locks and Dams Nos. 8 and 21.[10]

The comprehensive survey of the Upper Cumberland began in 1923 and resulted in a favorable report in 1926, recommending three, high power-navigation dams for the section of river between Carthage, Tennessee, and Burnside, Kentucky. The report envisioned cooperative public-private construction of the dams and locks, with the United States underwriting costs of the locks and private interests constructing and maintaining the dams under Engineer supervision. The Federal Power Commission, however, never took favor-

Steamboat *Rowena* in Lock 21 at Burnside.

District surveyor Samuel A. Weakley took this picture of the Nashville wharf on March 6, 1917.

able action on the applications by private companies to plan the development of water power on the Cumberland, with the eventual result being the planning and construction of the dams by the Corps of Engineers itself.[11]

Thus it happened that the Nashville-Chattanooga District had its "308 Reports" on the Cumberland and Tennessee well in hand before Congress authorized them for all major river basins in 1927. Indeed, the District set a precedent that was emulated across the nation.

Major Fiske and the officers who succeeded him as District Engineer—General Julian Schley and Colonel Lewis H. Watkins among them—were enthused by the prospects which the comprehensive surveys revealed, but they were subjected to much criticism because of their advocacy of high dams and multipurpose development. They often returned crestfallen to the District from meetings with other Engineer officers, because of the disparaging comments of their skeptical colleagues.[12]

It must be admitted, however, that Major Fiske, at least, in his boundless enthusiasm for comprehensive development, went beyond the bounds of military courtesy, corresponding directly with congressmen who were also excited by the revelations of the surveys. This resulted in a sharp reprimand from the Chief of Engineers who astutely warned Major Fiske that "if you will stop to think a moment you will readily see that if each district engineer took up directly with Members of Congress the question of improvements in his district . . a very embarrassing situation might readily arise. There is only one proper way to handle river and harbor matters with Congress and that is through the Chief of Engineers. . . ."[13]

No doubt the Chief was correct, but the fact remains that Congress was "astounded" by the surveys on the Tennessee and Cumberland and authorized similar surveys on other rivers. The subsequent "308 Reports" represented the first complete commitment of the Corps to multipurpose water resource development and were perhaps the most ambitious program of river basin planning in the annals of engineering.[14]

Major Fiske's tour of duty in the twin valleys was extended because of the importance of the work in which he was engaged, but after seven years he was transferred. He retired from the Corps and joined Col. John R. Slattery, who had also served as Nashville-Chattanooga District Engineer, in the construction of the Eighth Avenue Subway in New York City, and at last returned to the Tennessee Valley as chairman of the Chattanooga Electric Power Board. He suffered a fatal heart attack in early 1942, brought on, his biographer stated, by intense anxiety about his friend and classmate General Douglas MacArthur who was under Japanese attack on Corregidor.[15]

Major Harold Fiske left behind him an enduring legacy, for he had pointed the way to the comprehensive development of the great rivers of the United States. The *Chattanooga Times* said in tribute that "in a large sense the Tennessee Valley program and public power in this region are monuments to his foresight."[16]

In early 1930, the final "308 Report" on the Tennessee River was submitted to Congress, with the indorsement of the Chief of Engineers, who stated there had never been presented to Congress a "more thorough and exhaustive study." The report proposed a nine-foot minimum channel depth for the Tennessee, corresponding with the depth in the Ohio River, to be accomplished by build-

ing seven high dams on the mainstream to supplement the two—Hales Bar and Wilson—already in operation, plus a large number of reservoirs on tributaries for both power production and flood control.[17]

Congressional policy at that date did not authorize Federal participation in either hydroelectric power production or flood control on a general basis (though there were individual exceptions such as Wilson Dam). The "308 Report" on the Tennessee therefore contemplated the progressive development of the valley's water resources over a long period of time in cooperation with state and local government and private interests, with costs divided among them according to benefits received.[18]

On the other hand, the proposed nine-foot channel could also have been accomplished by the Federal government alone by construction of 32 low dams for navigation only. The plans for multipurpose development were obviously preferable, but the prosecution of such development appeared in 1930 to depend upon the cooperation of local interests under then existing law. Congress authorized the nine-foot channel soon after completion of the "308 Report," and provided for the construction

General Lytle Brown, native of Franklin, Tennessee, who served as Nashville District Engineer and as Chief of Engineers.

of 32 low dams for which high dams could be substituted under the provisions of the Federal Water Power Act of 1920; that is, the costs of high dams on the Tennessee would be shared by the Federal government with private interests, municipalities, or states.[19]

Had not other events intervened—primarily the Depression and the administration of Franklin Roosevelt—it is possible that a cooperative public-private development of the Tennessee might have proceeded as authorized, but such was not to be the case. When General Lytle Brown, Chief of Engineers, requested specific proposals from those interested in the construction of high, power dams, he found that all were hesitant because of the economic dislocation of the Depression and a hiatus in the growth of the demand for electric power. All were unwilling to commit themselves definitely to cooperative development in view of the uncertain economic future.[20]

General Brown therefore recommended proceeding with construction of the first of the 32 low dams to accommodate commercial traffic on the Tennessee, and in January of 1933 the Engineers began the construction of Lock and Dam No. 3 (later named Wheeler Dam) at Muscle Shoals, with funds provided by the Emergency Construction Act for the relief of the unemployed. It was to be the last construction by the Army Engineers for the benefit of navigation on the Tennessee, because a completely new agency was given the direction of the improvement of the river by the Roosevelt administration and Congress.[21]

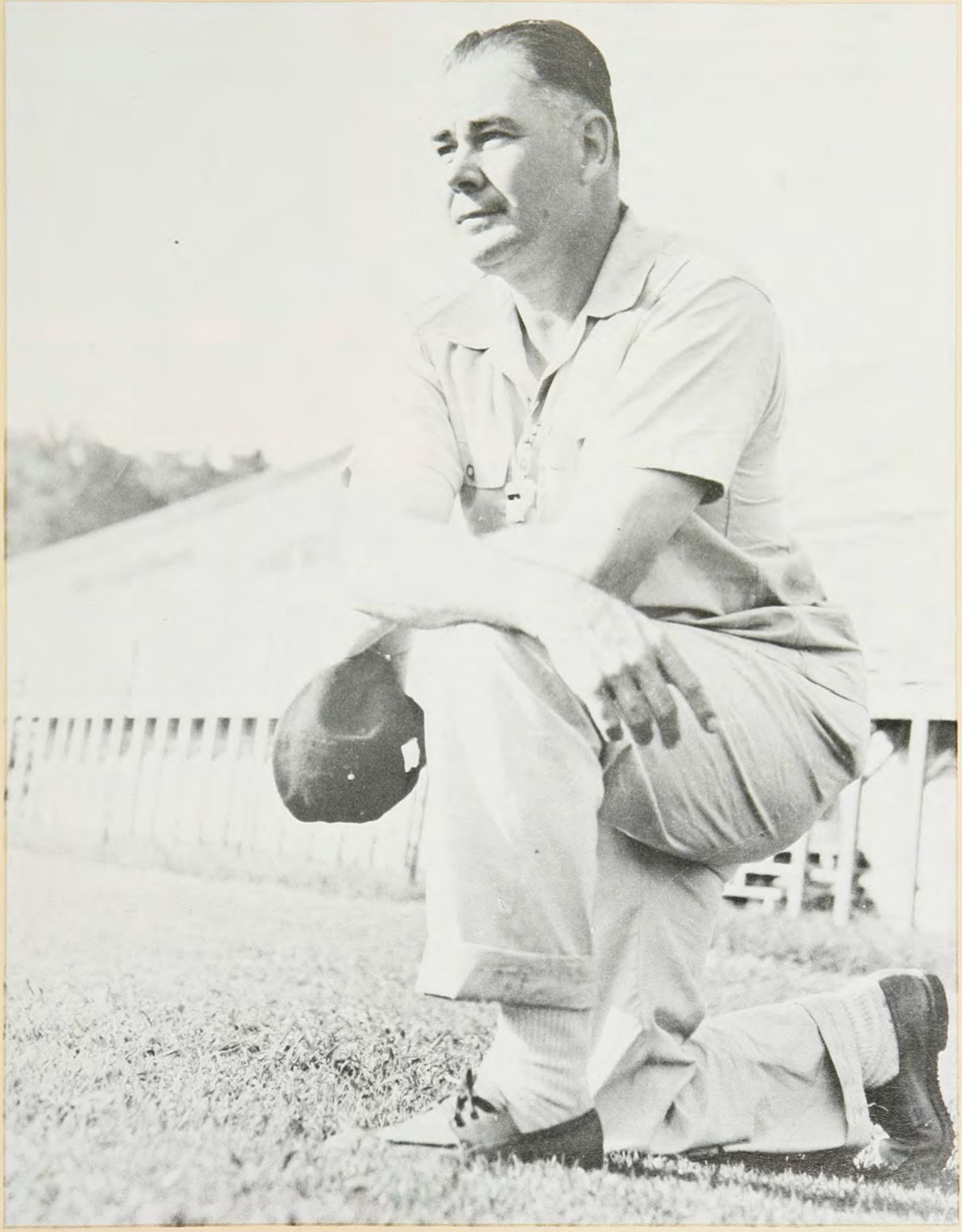
On May 18, 1933, supervision of the improvement of the twin rivers was divided by the act which created the Tennessee Valley Authority (TVA), representing a new, and well-publicized, departure in policy by the Federal government. TVA was authorized to market the power it produced and to experiment in several other areas, such as general land-use studies and regional planning. These were perhaps the most controversial of the innovations which the Authority represented, but more important to the future of the Tennessee Valley was the fact that ample funds were provided for the construction, in a relatively short time, of the high, multipurpose dams projected by the Engineers' "308 Report," thus eliminating the combined public-private development envisioned by the Engineers.[22]

The creation of the Tennessee Valley Authority was indeed a shock to the Engineers in 1933, especially at the Chattanooga Office, which had directed the improvement of the Tennessee River since 1867. General Lytle Brown abolished the Chattanooga District, effective August 1, 1933, and delivered to the Nashville District the responsibilities which the Engineers have retained in the Tennessee Valley since that date.[23]

By coincidence, the termination of the existence of the Chattanooga District occurred when one of the most dynamic and perhaps the best known Engineer officer in the Chattanooga District's history was in command. He was a superb athlete by the name of Robert R. Neyland, whose fiery energy enabled him to bear two careers on his shoulders simultaneously. He served in the A. E. F., was aide-de-camp to General MacArthur at West Point, taught military science at the University of Tennessee, and was Nashville-Chattanooga District Engineer before he retired in 1936 to devote full time to his other career, which he described as his "hobby."[24]

His hobby needs little discussion here, for General Neyland was a college football legend, enshrined in the Football Hall of Fame. He coached the University of Tennessee "Vols" from 1926 through 1940, going undefeated in the 1938, 1939, and 1940 seasons. The Army required his services in another team effort in 1941, and he served with distinction in the difficult China-Burma-India theater as Commanding General, Service of Supply. He returned again to his "hobby" at the end of the war as athletic director at the University of Tennessee.[25]

Immense personal energy and driving force enabled General Neyland to carry out his multitudinous responsibilities effectually. He often completed routine paper work in the back seat of an automobile while hurtling along the highways between Nashville, Chat-



General Robert R. Neyland, Nashville District Engineer, was better known to Tennesseans as coach of the University of Tennessee Volunteers.

tanooga, and Knoxville. Dictatorial, brilliant, meticulous, he inspired the Tennessee "Volunteers" to a record of 171 victories, 27 losses, and 12 ties, bringing the University national recognition and building a superb athletic plant at the home of the "Big Orange." Neyland Stadium at Knoxville became the General's monument.[26]

But it was a sad day for General Neyland when he received orders to close the Chattanooga Engineer Office in 1933, and there was great consternation in the Mountain City, whose citizens had fought long and hard to keep an Engineer Office open there. A local newspaper editor claimed the end of the Chattanooga District was a result of quarreling between the Army Engineers and the newly-formed TVA. "Chattanooga," he lamented, "is a sort of innocent bystander who has been shot by a duelist." But such was not the case. There was some friction between the two agencies during the early days, largely the consequence of the vagueness of the act which created the Authority, but these conflicts were gradually resolved as the intent of Congress was clarified and the division of responsibilities between the Authority and the Engineers on the Tennessee was firmly established.[27]

General Lytle Brown, Chief of Engineers, even extended his best wishes privately to Chairman Arthur E. Morgan of the Authority, declaring cryptically: "This is fly time and we must thicken our hides or have our minds diverted from the business in hand. You will have to pass through much tribulation, but I hope you will come out with great success and satisfaction to yourself and those whom you are trying to serve."[28]

After his retirement, General Brown publicly proclaimed that, though he had favored the private development of the Tennessee early in the Roosevelt administration, his later experiences and the fine work TVA did, "after the private utilities twiddled their fingers and did nothing for so long," had changed his mind. "I think my testimony now," he continued, "would be that after they get the first crack and fail to take advantage of their opportunities, the government

The steam packet *Jo Horton Fall* was one of the last in regular service on the Cumberland. The packet is docked at the Nashville River and Rail Terminal in September 1927.

Opening the lock gates took manpower.

Derrick boat raising lock gate for repairs at Lock A, Cumberland River.

"Doubling" at old Lock D on the Cumberland.

Setting emergency dam for repair of upper lock gate at Lock A, Cumberland River.

Placing concrete caps atop the old timber-crib dams on the Cumberland about 1935.

should step in and do the job. These rivers belong to the people, the people need industrial development in our section of the country, and cheap power is one of the biggest drawing cards for industry."[29]

His tribute to the work of TVA, coming as it did from one of the most conservative officers in the Corps, was significant. General Brown was a veteran of the Spanish-American War, the Philippine Insurrection, the Mexican Expedition, and World War I. In the great tradition of the Corps, the General had prepared a ford across a creek at the base of San Juan Hill under Spanish fire in 1898, in order that Teddy Roosevelt and the Rough Riders along with other less-publicized units might cross easily to make the famous charge up the Hill. General Brown then personally joined the attack, leading a detail of skirmishers to drive Spanish sharpshooters out of the trees.[30]

His record as a combat engineer was matched by his record on Engineer projects across the nation and in the territories. He was Chief of Engineers from 1929 to 1933 and commanded the Panama Canal Department until he retired to his home in Middle Tennessee in 1936. When General Brown expressed admiration for TVA's work on the Tennessee it was assuredly an honest opinion shared by many others.[31]

In 1933, General Brown did his utmost to smooth the transfer of responsibilities on the Tennessee. The Corps turned over its records and property to TVA, transferred some Chattanooga personnel to the Nashville District, though many were employed by the Authority, and furnished technical assistance to TVA during its initial organization. The Engineer Department's fleet and equipment on the river were loaned to the Authority on a reimbursement basis for the completion of Wheeler Dam, which opened to traffic on November 27, 1934, and, by agreement with the Authority, the Nashville District designed the locks for several other high dams built by the Authority on the Tennessee.[32]

Since the Corps of Engineers is responsible by law for operation and maintenance of all navigable inland

waterways in the United States, it has retained important responsibilities on the Tennessee since the creation of TVA. In 1946 the two agencies signed a memorandum of agreement to prevent overlapping and duplication of effort, and representatives of the two agencies have since met annually to discuss planning and mutual problems. The principal duties of the Army Engineers on the Tennessee after 1933 consisted of the operation and maintenance of locks and other aids to navigation, the maintenance of navigation channels, the promulgation of rules and regulations governing the navigation of the waterway, the construction of certain flood control projects authorized by Congress, the compilation of statistics on waterborne commerce, and the examination and approval of wharves, intakes, pipelines, wire crossings, and other works prior to construction.[33]

Cooperation, on the whole, has been excellent between the two agencies, as General Herbert D. Vogel asserted in 1956: "A spirit of teamwork has continued between these two agencies of government throughout their association, and as an officer retired from the Corps of Engineers and now working with TVA, I have observed this close cooperation with pleasure."[34]

The team spirit, to which General Vogel referred, has even extended in certain cases to military activities. As an example, in 1936 the Authority made certain reinforced concrete structures in the Norris Reservoir area available to the Engineers for experiments with military demolition. An Engineer detachment from Fort Benning, Georgia, destroyed several bridges along the Clinch River to compare the effects of TNT with those of nitrostarch, proving the value of the latter explosive and making a significant contribution to the war effort which followed five years later.[35]

Full responsibility for the development of the northernmost twin, the cantankerous Cumberland, was retained by the Corps of Engineers, but the public was often confused because TVA acquired the Great Falls Dam on the Caney Fork when it purchased the assets of the Tennessee Electric Power Company, because TVA constructed steam electric plants in the Cumberland Basin, and because TVA purchased most of the power produced by Engineer installations on the Cumberland.

Even a President appeared confused in 1963 when John F. Kennedy visited Nashville to initiate construction on the Cordell Hull and J. Percy Priest projects and to observe the Ninetieth Anniversary of the founding of Vandervilt University. At Vanderbilt University's Dudley Stadium, the President pressed a golden key to detonate a charge at the Cordell Hull project, breaking ground for one of the Nashville District's dams, but in his speech that day he made no mention of the Nashville District, though paying high tribute to TVA on its Thirtieth Anniversary. His only mention of the Corps of Engineers merely compounded the confusion, for he referred to it as the "Army Corps of Engineers of the Tennessee Valley." That this elicited no chuckles from the crowd is an indication of the public relations problem the Engineers on the Cumberland have met with for the past two score years.[36]

It will be recalled that Major Harold Fiske initiated the comprehensive study of the Cumberland River Basin in 1923. It was a most fortunate time to undertake such a study, because the period not only included one of the most severe drouths in the Cumberland Basin, but also the record high stages on the mainstream of the river from Carthage, Tennessee, to Ashland City, Tennessee.

The drouth of the summer of 1925 left the river so low that the bare, rocky bones of its bottom were exposed; it was so low in many places that the trusty "Model T's" could roll up and down the channel wetting only their tires. It might be added that the river bed was probably more easily navigated by the automobile than some of the roads of the region in those days—District employees who traveled those roads still recall them with many choice expletives. As late as 1935, two employees who were ordered to make a trip from Nashville to Rowena, Kentucky, were only able to get within ten miles of their destination in an automobile and had to rent a mule-drawn wagon to complete the journey.[37]

A Corps of Engineers survey party navigates the Cumberland near Burkesville, Kentucky on September 7, 1925. River flow at the time was about 70 cfs.

In December of 1926 and January of 1927, Nature compensated for her mistake of 1925 by deluging the Cumberland Basin with billions of raindrops which, joining forces, produced the greatest flood ever seen on the mainstream of the Cumberland above Nashville, although possibly exceeded by the unrecorded flood of 1793. Each tributary stream and river—the Laurel, Rockcastle, the Big South Fork, the Caney Fork—made its own contribution to the team effort and soon a disastrous flood crest was roaring down the Cumberland Valley. Merchants on lower Broad Street in Nashville moved their merchandise up to the first floor, then to the second, and finally gave up and rowed home. Farmlands miles from the river bank were inundated. Damages were really incalculable, because not only crops and property were lost—how can the price of human life and misery be calculated?[38]

The flood of 1926-27 opened the eyes of the people of the Cumberland and of the Ohio and Mississippi valleys below, and an intensely vocal support for flood control plans developed. In 1933, the Engineers' "308 Report" on the Cumberland, which had been a decade in preparation, made flood control a major objective of comprehensive plans for the river. General Lytle Brown termed the report the "best that can be devised," but pointed out that existing law did not permit the Engineers to build projects for flood control or power development. Of course, the personnel of the Nashville District were aware of this, and District Engineer Frank S. Besson, Sr., recommended instead that immediate steps be taken to raise the crests of Dams No. 1

East Nashville flooded by the Cumberland River on December 30, 1926, when the Nashville gage read 55.7 feet.

When the Nashville gage hit 56.2 feet on January 1, 1927, Lower Broadway was flooded.

and A to F below Nashville to increase the low-water project depth for navigation.[39]

Hence, 1933 was a pivotal year in the history of the Nashville District. It received the remaining responsibilities of the Engineers on the Tennessee River; it completed the "308 Report" on the Cumberland River; it initiated plans to achieve a greater channel depth on the Cumberland below Nashville; and it was placed in the newly-formed Ohio River Division.

The Nashville District was withdrawn from the Upper Mississippi Valley Division and placed in the Ohio River Division (ORD) on November 28, 1933. The new division embraced the entire watershed of the Ohio River and its tributaries, with headquarters at Cincinnati. In addition to the Nashville District, ORD included four Ohio River Districts: Pittsburgh District, Huntington District, Louisville District, and Cincinnati District. The latter district was abolished in 1947 and its functions transferred to other districts, but, except for this change, this administrative organization has remained substantially the same since 1933.[40]

The need for increasing the depth of the Cumberland's channel arose from the perfection by marine engineers of powerful diesel towboats and standard welded steel barges, which appreciably lowered operational costs for waterways transportation. This new equipment encountered many difficulties in plying the Cumberland because of the shallow channel depth (a bare six feet) of the old canalization project.[41]

The Apex Oil Company began using modern equipment on the Cumberland in 1932, pushing barges of petroleum products up to Nashville where they pumped directly into tank trucks because the company did not have a "tank farm." Successful utilization of the Cumberland for movement of petroleum brought support for a deeper and more navigable channel on the river. W. D. Hudson of Clarksville, President of the Tennessee Oil Men's Association, wrote Congressman Joseph Byrns late in 1932, urging the raising of the old dams: "Last June I put into operation for my company

1926 flood in Burnside, Kentucky.

a gasoline barge from St. Louis to Nashville. Since that time I have hauled in these barges more than 3,000,000 gallons of gasoline. The result of this barge line has been the saving of 2¢ per gallon to the consumers of gasoline in this territory. . . . The consumers of gasoline alone are saving enough to pay for the cost of all the locks on Cumberland River in one year."[42]

A savings in the transportation costs of gasoline of merely one mill per gallon can be an important competitive edge in the petroleum business, and the smaller concerns which initiated petroleum barging on the Cumberland were soon emulated by Gulf, Standard, and others. By 1939, the oil companies had terminals for the transfer of petroleum products in operation on the Cumberland at Dover, Clarksville, Ashland City, Nashville, and Carthage, Tennessee.[43]

The beginning of petroleum barging on the Cumberland corresponded with a real turning point in the history of navigation on the Cumberland: the installation of movable wickets (A-Frames) on the crests of Dams Nos. 1 and A to F below Nashville was authorized in 1933. The project was part of the public works program of the Depression years under the National Industrial Recovery Act; the Public Works Administration allotted

The first Cumberland River petroleum tow, the *Helen H.*, entering Lock 1 on June 24, 1932. She towed two barges containing 300,000 gallons of gasoline.

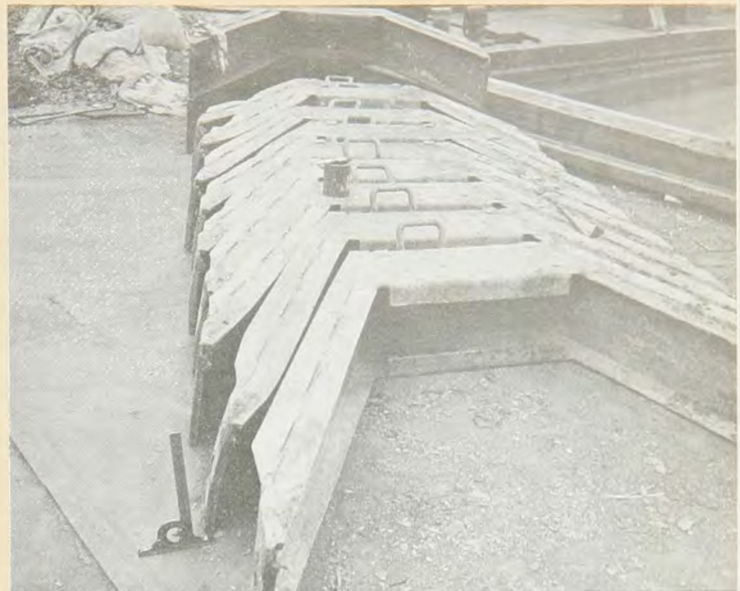
Steam towboat *Destrehan* pushing a petroleum tow up the Cumberland at Ashland City on September 14, 1935.

$868,000 to fund the installation of A-Frame wickets and concrete caps atop the old timber-crib dams. Previous experiments had placed the wickets near the bottom of rivers where they were silted over and lost during high water, but placing them atop the old dams proved quite effective. This was the first successful large-scale application of the A-Frame wickets in the United States.[44]

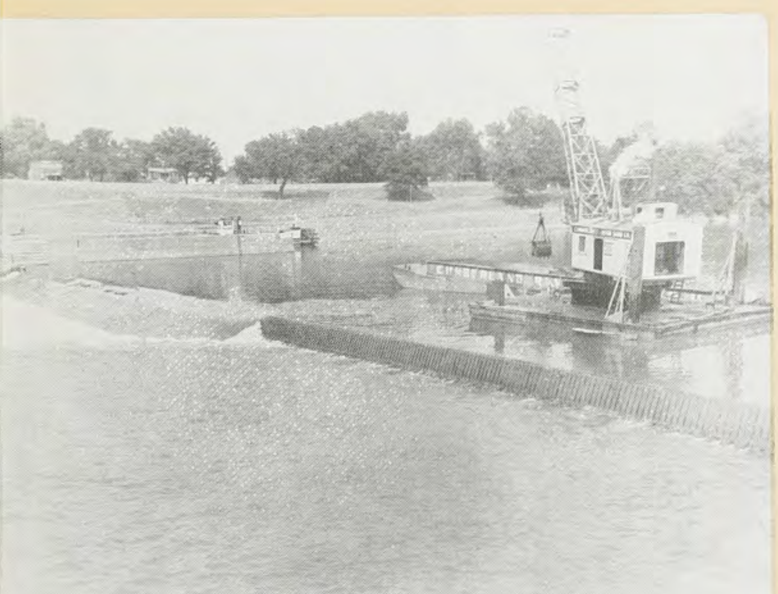
The steel A-Frames were each about a foot wide and high enough to add another three feet to the depth of the pool behind the dam. During highwater stages, they were collapsed sideways to form a flat bed on the dam and permit the unimpeded passage of flood waters, debris, and river traffic. After the river subsided, the wickets were raised by tossing a steel grappling hook into the river, catching the wickets, and raising them, one by one, into an upright position, thus securing a navigable channel during the low-water season. Installation of the wickets was accompanied by improvement in the old dams: the top portion of the old timber cribs was removed and replaced with a reinforced concrete cap, piling was driven into foundation rock throughout the old dams, and lumber sheeting was replaced by steel-sheet piling driven to rock along the upstream face of the dams.[45]

Though only a six-foot project depth was authorized, this was an ingenious way of maintaining at minimum expense a dependable channel for the new river traffic until the comprehensive development of the river could be initiated. The wickets had the immediate result of decreasing the amount of maintenance required to clear sand and gravel shoals from the channel and of facilitating a rapid growth of commerce on the Cumberland. Of course, the increase in traffic on the river which followed can not be attributed entirely to the installation of the A-Frames, for by 1935 the nation was beginning to emerge from the depths of the Depression; but without them it is highly unlikely that the traffic on the Cumberland would have shared in this return to more prosperous conditions.[46]

Momentous legislation was enacted by Congress in 1936 and 1938 which had important consequences in the Cumberland Basin; for the first time in the history of the United States, a definite policy for nationwide participation by the Federal government in the control of floods and reduction of flood damages was established. The Flood Control Act of 1936 set this new policy and it was reaffirmed in the Flood Control Act of 1938, which also authorized the comprehensive plans of the Engineers for flood control and other



Above: wickets on Dam C, 1934
Below: wickets partly raised
Top right: collapsed A-Frame wickets
Right and below right: raising the wickets



purposes in the Ohio River Basin, inclusive of certain projects in the Cumberland Valley. Under this authorization, the Nashville District began detailed studies of reservoir sites and local flood control projects, but, as this work got underway, action was pending in Congress on proposed legislation which might have ended the history of the Nashville District.[47]

When the people of the Cumberland Valley looked south after 1933 and saw the pumping of funds into the comprehensive development of the Tennessee Valley, they turned as green as their valley. They felt slighted, for they considered their river just as important as its twin to the south, and the Engineers' "308 Report" on the Cumberland had demonstrated that comprehensive development was feasible. The Cumberland Valley Association set out in 1937 to press Congress for comprehensive development, and, in the belief that inclusion of the Cumberland in TVA would accomplish their desire most swiftly, the Association made a demand:

> We want the Cumberland River system included in the Tennessee Valley Authority!
>
> The Cumberland has always borne twice the freight traffic of the Tennessee, and has been of the greatest importance to the life of our region.
>
> The Cumberland has always had a flood-control problem even more serious than that of the Tennessee.
>
> Many of the ablest and most public-spirited leaders of the Cumberland River Valley during past years almost wore their lives out to obtain what little help this river has received from the Government.[48]

The sentiments of the Association found support among several newspapers of the region, notably the Nashville *Tennessean*, and a series of bills to turn the development of the Cumberland over to TVA were brought before Congress. Senators George Norris of Nebraska, Kenneth McKellar and Estes Kefauver of Tennessee, and several congressmen sponsored such bills, receiving the strong support of the Roosevelt administration. In 1945, for example, President Roosevelt directed TVA to prepare a report on the integrated development of the twin rivers, and the report of the Authority was that the two rivers were so similar and their problems so interrelated that their development should be amalgamated under one agency.[49]

There was much opposition both in Congress and in the Cumberland Valley to such an expansion of the Authority's program, however, and, while the debate was in progress, the Engineers began the comprehensive development of the Cumberland and its tributaries as outlined in the "308 Report." Support for the extension of the Authority's control to the Cumberland gradually decreased as the Engineers' program progressed. The Nashville *Tennessean*, which supported most vociferously the transfer of the Cumberland from the Engineers to TVA—for two decades it carried a slogan to this effect on its masthead—changed its editorial policy in 1953 when its editors realized the comprehensive development of the Cumberland would be vigorously prosecuted under the administration of the Engineers.[50]

The Army Engineers initiated flood control in the Cumberland Valley by constructing a local protection project at Middlesboro, Kentucky, in the Upper Cumberland Basin. The town was ravaged almost annually by near flash floods, and after a disastrous flood in 1929 it appealed to the United States for aid in alleviating its flood problems. The Nashville District investigated and found that Middlesboro could be partially protected, but because flood control projects were not authorized in 1930 the Engineers' hands were tied.[51]

The historic Flood Control Act of 1936 altered this situation, and in 1937 the Nashville District went to work at Middlesboro, using emergency relief funds to defray a portion of the costs. Canals and levees were constructed around one side of the town to divert Yellow Creek from its course through the heart of the business district, and, though the project was not designed to provide complete protection for the entire city, it greatly reduced flood damages there after its completion in 1939. During the post-World War II period, additional protection was provided for the city on the downstream reach of Yellow Creek.[52]

Another early local flood protection

General Julian F. Schley breaks ground for Wolf Creek Dam, September 1, 1941. To his right are Colonel O. E. Walsh and Colonel C. Lacey Hall.

project was authorized in 1937 at Pineville, Kentucky, the county seat of Bell County on the west bank of the Cumberland, just a few miles from historic Cumberland Gap. The Nashville District completed plans for levees, drainage works, and pumping stations for the protection of the town, but local cooperation requirements were not met, a neglect for which Pineville paid dearly when it was submerged by a calamitous flood in 1946.[53]

Under the authorization of the Flood Control Act of 1938, which, following the record flood on the Ohio of 1937, directed the construction of tributary reservoirs for the protection of the Ohio River Basin, the Nashville District investigated six reservoir sites: Wolf Creek on the Upper Cumberland River, Dale Hollow on the Obey River, Center Hill on the Caney Fork River, Stewart's Ferry (J. Percy Priest) on Stone's River, Three Islands on the Harpeth River, and Rossview on the Red River. The investigation led to the choice of the Wolf Creek project for immediate construction in 1941.[54]

The Wolf Creek Dam in Russell County, Kentucky, impounded a reservoir extending 101 miles up the Cumberland River. The dam, designed for flood control and hydroelectric power generation, had a length of 5,730 feet and soared to a height of 242 feet, and was one of the largest dams in the Eastern United States. Its capacity for water storage was greater than that of Kentucky Lake, though it covered only about a quarter of the area, and when construction was initiated, its ultimate power-generating capacity was equal to all the power

Ferry across the Cumberland just above Cumberland Falls about 1950.

produced in the remainder of the Commonwealth of Kentucky.[55]

Thousands of trucks, automobiles, and wagons crowded the dusty roads to Rowena, Kentucky, on September 1, 1941. They were on their way to see the ground-breaking ceremonies for Wolf Creek Dam; ceremonies which were described by one of the congressmen present as "the declaration of independence of the plateau region, industrially." After rounds of refreshments, while bands played their lungs out, Chief of Engineers Julian L. Schley, a former Nashville District Engineer, turned over the first shovelful of dirt, initiating the multipurpose development of the Cumberland Basin.[56]

Just three months later, the thud of bombs and staccato of guns at Pearl Harbor forced upon the Engineers, as the rest of the nation, the greatest military effort in its history. As part of this effort, Congress directed that construction of the Wolf Creek Project be rushed to furnish power for Southeastern war industries, and authorized construction of the Center Hill and Dale Hollow projects on the Caney Fork and Obey rivers to be funded by defense appropriations. Planning was rushed and construction of Center Hill and Dale Hollow projects began in March of 1942. The implementation of the comprehensive plans for the Cumberland Basin thus became a part of the Nashville District's prodigious military effort against the Axis powers.[57]

CHAPTER XI

THE MILITARY MISSION

The tragic events of December 7, 1941, brought to the Army Engineers their greatest challenge in history. Military construction was not entirely new to the Nashville District in 1941, but nearly a century had elapsed since the Engineers had engaged in a large-scale military construction program in the Tennessee and Cumberland valleys. The old stone and earth fortifications the Engineers had constructed throughout the twin valleys during the Civil War could still be seen, but the crumbling remains had become merely tourist attractions.

From Appomattox to Pearl Harbor, the mission of the Corps of Engineers in the twin valleys had been limited largely to civil works, while military construction was performed under the general direction of the Quartermaster Corps and the Ordnance Department of the Army. Individual Engineer officers and employees of the District made substantial contributions to the success of American arms during the Spanish-American War of 1898 and during World War I, but the resources of the District organization were not mobilized to any considerable extent for the military construction mission.

Though the overseas military construction operations of the Engineers in 1917-18 were voluminous and the combat engineers were the first to enter action and suffer casualties in France, the effect of World War I on the Nashville-Chattanooga District was minimal. One effect resulted from the great demand for Engineer officers in the combat theaters: a need so great that not enough officers remained to direct the civil works program. The District had its only civilian District Engineers—Walter S. Winn and Anson B. McGrew—during the First World War.[1]

The major construction of a quasi-military nature initiated in the District during the First World War by the Engineers was the massive project at Muscle Shoals, Wilson Dam, which was to produce power for manufacture of nitrates. The project would perhaps have been vital had the war continued for several years, but it became instead, a postwar political fotball. The District's civil works program as a whole was nearly suspended in 1917, because of shortages of materials and a curtailed working force; curtailed because many employees left the District for military service or to accept positions on military construction projects. Only about twenty per cent of the proper working force was available for projects on the Cumberland River at one point during the war.[2]

Because the District was located far inland, there seemed no danger of sabotage in 1917 and guards were not employed to protect the locks on the Cumberland, but complacence ended after a suspected sabotage attempt at Lock and Dam No. 21 near Burnside, Kentucky. On the evening of May 4, 1917, a month after the declaration of war, the lockmaster at No. 21 observed lights signaling to each other, went to investigate, and saw the lights recede quickly as he approached. He discovered a wired package attached to the lock wall, and found that it, containing black powder, cotton, graphite, and an unexploded shotgun shell cap, was not properly devised for detonation. John S. Butler, who personally investigated, concluded that either the saboteur was improperly trained, or the whole matter was a

dangerous practical joke.[3]

General Lansing H. Beach, Division Engineer at the time, astutely remarked the incident might have been the scheme of someone who desired employment as a guard, and he directed the District Engineer to examine those who applied for the position very closely. The District Engineer replied that no guards had been employed on the Cumberland at all and that no intimations that any would be employed had been made. The incident had its effect, however, and shortly thereafter armed guards were stationed at every lock to prevent sabotage or similar damage.[4]

The military construction activities of the Engineers in the twin valleys were minor from 1917 to 1919, but the contributions of the twin rivers and the entire inland waterway network to the nation's defense were significant. At the conclusion of the war, the Chief of Engineers, Lansing H. Beach, echoing John Calhoun, called for further improvement of the inland waterways as a preparedness measure:

> "The interest of the Federal government in the construction of comprehensive road and interior waterway system throughout the United States ... is far greater as a measure of defense than for commercial reasons, great as is the necessity of these for the latter purposes. This statement is made advisedly, for the preservation of the life of the Nation is the central government's greatest responsibility in peace and in war, and hence every facility should be developed to allow a successful defense to be made. It fortunately happens that roads and waterways constructed solely to meet the needs of commerce are generally well adapted to the needs of defense, and the immediate interests of the people can be counted on to secure support for this great preparedness measure."[5]

Another lesson taught, but not learned, by the war was the value of hydroelectric power to the national defense. From 1916 to 1918, an enormous demand for electric power to whirl the machines turning out war materials arose, but the potential hydroelectric power of the nation's rivers was largely undeveloped. Coal and more coal was demanded by steam plants to produce the vital power, but there was a shortage of both coal and of railway transportation to move it to the plants. The lesson was that hydroelectric power was just as crucial to national defense as it was to the conservation of irreplaceable mineral resources and to peace time industrial development, but the controversy which ensued between the two world wars over who would develop the latent power of the nation's rivers prevented full development of the water resources assets of the Republic.[6]

There was hope when war began anew in 1941 that the three multipurpose projects authorized in the Upper Cumberland Basin—Wolf Creek, Dale Hollow, and Center Hill—would be rushed to completion by 1944, because of the power they would produce, but when the full impact of the titanic military effort was felt by the Engineers in 1942 these hopes were frustrated. The exigencies of global war made manpower, materials, and construction equipment critical to the defense effort, and the Engineers suspended construction on civil works as soon as it could be safely accomplished. The Wolf Creek project, about three per cent completed, and the Center Hill project, about eight per cent completed, were suspended for the duration of the war. Since the Dale Hollow Dam on the Obey River was about nineteen per cent completed, the dam was rushed to completion, but construction of the power generating facilities was discontinued.[7]

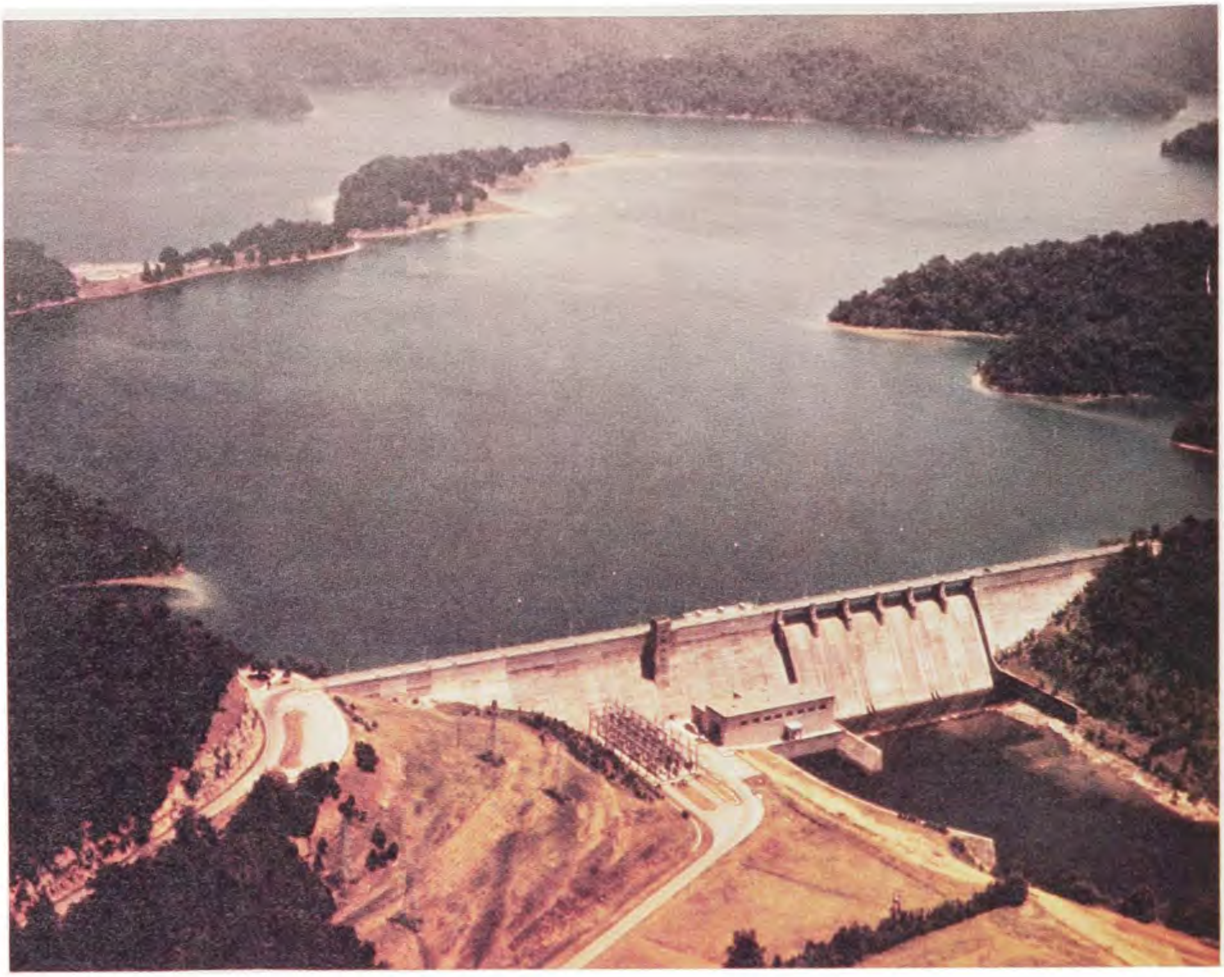
Despite poor weather, a severe flood in late 1942 which damaged construction facilities, and a critical shortage of practically everything, Dale Hollow Dam was brought to essential completion by June 30, 1943. It was thus ready for use when a destructive flood raged down the valley in the spring of 1945, and it was the first reservoir in District history to be credited with the reduction of flood damages. Its operation alone lowered the crest of the flood at Celina, Tennessee, by an estimated 4.5 feet.[8]

But the civil works mission was a relatively minor concern of District Engineer Orville E. Walsh after Pearl Harbor, for the volume of urgent military construction was enormous—would have been overwhelming to a man of

ordinary abilities. Colonel Walsh, graduate of West Point in the Class of 1918, was well prepared to deal with the imperative mission thrust upon him and the Nashville District. In the interim between the world wars, the Colonel had served in Germany, China, the Philippines, and Panama, and was District Engineer at Kansas City while planning for Fort Peck Dam was underway. When he became Nashville District Engineer in 1940, planning for construction of three massive reservoir projects was underway. By the time he was reassigned, in January of 1943, the District had completed the most urgent construction program in its history, meeting the goals assigned to it, and Colonel Walsh was awarded the Oak Leaf Cluster to the Legion of Merit for "exceptionally meritorious service in carrying out the mission of the Nashville Engineer District."[9]

Colonel Walsh and the District actually received a military mission before Pearl Harbor. In the fall of 1940, the President placed the Airport Construction Program of the Civil Aeronautics Authority under direction of the Corps of Engineers, and transferred construction for the Army Air Force from the Quartermaster Corps to the Engineers.[10]

Colonel O. E. Walsh, Nashville District Engineer, 1940-43



Dale Hollow Dam and Powerhouse on Obey River in Clay County, Tennessee. It was the first in Nashville District to operate for flood control.

During the waning days before that December Sunday in late 1941, the Nashville District mobilized for its military mission. Besides airfield construction for the CAA and the AAF, the District received several confidential assignments, one being the choice of a location of a suitable site for a prisoner of war internment camp. After examination of numerous locations, a site near Crossville, Tennessee, in Cumberland County was selected.[11]

By the time construction of the internment camp became necessary, planning was in such a forward condition that the District was able to have it ready for occupation by March 1942. Civilian Conservation Corps buildings were dismantled at Wartburg and Jamestown, Tennessee, transported to the camp site, and re-erected to furnish a portion of the over five hundred buildings thrown up to serve as barracks, bath-houses, latrines, and mess halls. In addition, guard towers, an infirmary, and a fire-station were built, and the entire compound was surrounded by a barbed-wire double-stockade to protect the inmates.[12]

When the United States entered the war, the Engineers were in the throes of consolidation, for on December 1, 1941, the President had given orders to amalgamate the Construction Division of the Quartermaster Corps into the Engineer organization within fifteen days. This meant that practically all American military construction became the responsibility of the Engineers and enormously increased the work load of the Nashville District, as it did the entire Engineer Department.[13]

Consolidation appears to have been executed swiftly, with very little friction, in the Nashville District. In general, it was

Prisoner-of-war internment camp at Crossville, 1942. (above)
Construction of prisoner-of-war quarters, Crossville internment camp, 1942. (below)

accomplished merely by changing the title of Quartermaster officers and restructuring the chain of command. As an example, the Constructing Quartermaster at Camp Forrest, a troop cantonment near Tullahoma, Tennessee, was Captain George H. Graham. On December 16, 1941, his title was changed to Area Engineer and instead of reporting to the Quartermaster Corps he reported to the Nashville District Engineer. Captain Graham later served as Area Engineer for Camp Forrest Airfield, the Air Corps Ferrying Command at Nashville, and Swannanoa (Moore) General Hospital near Asheville, North Carolina.[14]

Thus, by early 1942, the peak year for military construction in the United States, consolidation was essentially complete and the Nashville District was operating under emergency conditions, closing down construction at three huge flood control projects, building airfields for the CAA and AAF, and directing far-flung military construction activities. It was a confusing situation, with the personnel of the District swarming over all the Tennessee and Cumberland valleys on both civil and military construction. The situation was further complicated by certain highly classified activities within the District's boundaries for which two separate Engineer Districts were created—the Kingsport and Manhattan Districts.

The capacity of the old Engineer Office at Nashville was strained to the utmost, the ancient gray stones practically bulging, and sections of the Office spilled over into several other buildings in the city—the Bennie Dillon Building, the YMCA, and the 226 Capitol Blvd. Building. Older employees, accustomed to carrying out their civil works mission in full public view, were disconcerted by the tightest security precautions in the District's history.[15]

Male employees were further distracted by the rapid tattoo of high heels flying from office to office as the manpower shortage was alleviated by woman power. Female employees were not new to the District—the very able Miss Alice Lenora Carter served the District in various clerical and administrative capacities from 1893 to 1931, as example—but the new employees, in their Rita Hayworth and Veronica Lake styles, were rather shocking to their staid male colleagues.[16]

War time restrictions on certain scarce commodities also had an effect on the District's day-to-day operations. To conserve rubber, gasoline, and parts, the War Department ordered a maximum speed limit of 35 miles per hour on all motor vehicles, a provision which pleased the Safety Branch immensely, and, for the first time in many years, hay-burning mules could be seen on Engineer projects hauling materials and pulling scrapers.[17]

Nashville became a veritable beehive, with its streets swarming night and day with troops from Camp Campbell, Camp Forrest, Smyrna Air Base, and other installations near the city. Union Station was packed by crowds thronging to meet trains, and both river and rail routes into the city were strained by the load of war materials flowing in and out of the city. Nashville was, in short, converted into a giant depot again, as it had been in 1862, while the Cumberland was bridged by pontons, for the first time since the Civil War, as 500,000 troops of the Second Army conducted training maneuvers for combat.[18]

District Engineer Orville E. Walsh was ordered to a combat theater in early 1943, and was followed shortly thereafter by the subsequent District Engineer, William A. Davis. In late 1943, Colonel Reading Wilkinson, a veteran of Guadalcanal, assumed command of the District, though he was still suffering from a disease contracted in the South Pacific.[19]

Many District employees joined their Engineer officers in service around the globe, and those who could not made their own personal sacrifices. The most extraordinary example of the latter was the case of W. A. "Pop" Dealy, head of the Reproductions Branch, whose five sons joined the Army Air Corps. Four of them went down over Germany and "Pop" went through many agonizing hours, but all came through the war safely.[20]

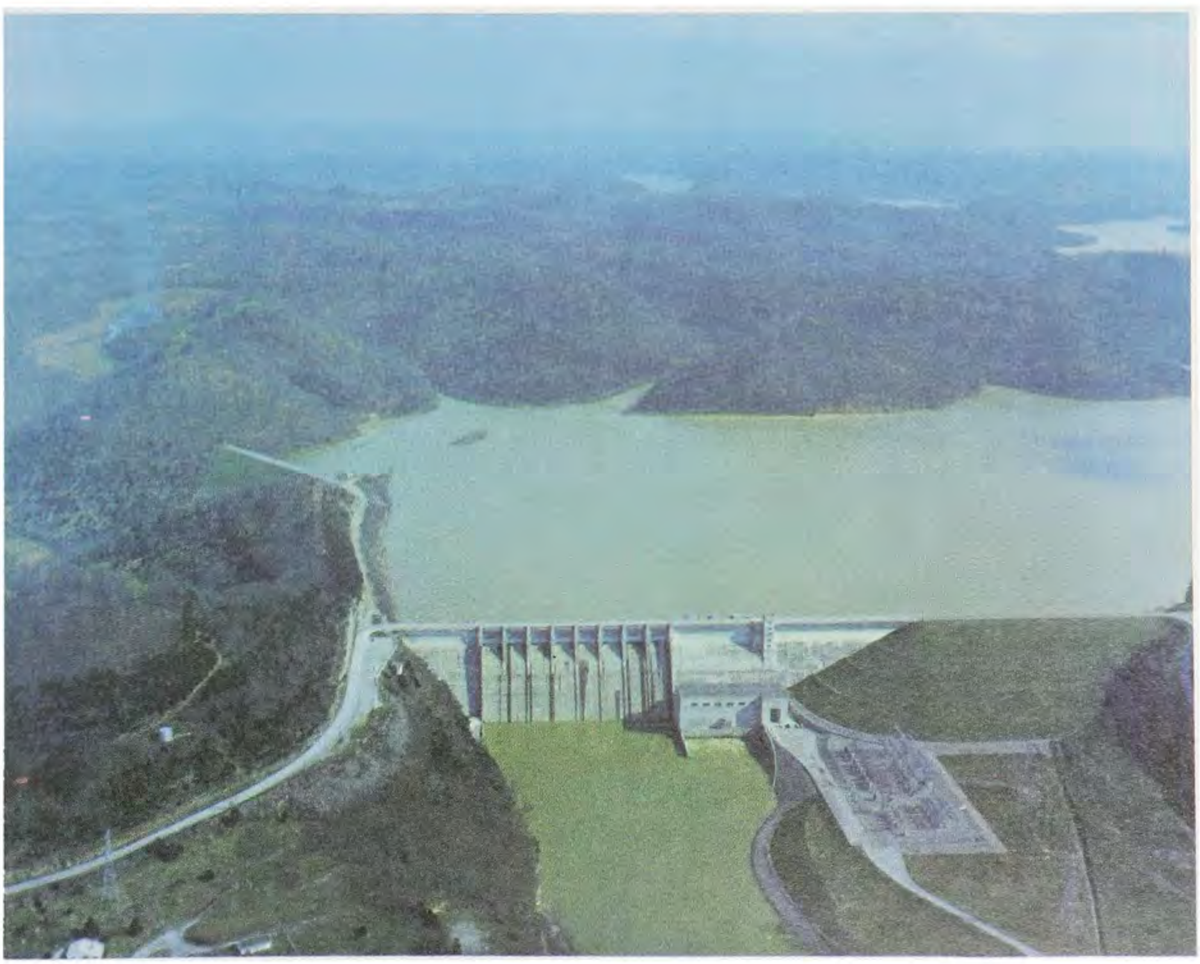
When the District's military construction effort peaked in 1942, the Engineers

were directing the construction of airfields, army cantonments, ordnance works, prisoner of war impoundments, hospitals, and were inspecting much of the military equipment and supplies flowing through Nashville. The scope of the District's activities ranged from the mouths of the twin rivers at Paducah and Smithland to the headwaters high in the Appalachians.

At Paducah, the District directed construction of the Kentucky Ordnance Works; at Muscle Shoals, it built a CAA airport, Courtland Basic Flying School, and a TNT plant; at Milan, Tennessee, it constructed Milan Ordnance Works; near Asheville, North Carolina, the Swannanoa General Hospital, later renamed Moore General Hospital in honor of Dr. Samuel P. Moore, Surgeon General of the Confederacy, was erected with 1520 beds and a hospital training unit for 661 officers, nurses, and enlisted men. When the Chief of the Chemical Warfare Service requested the Engineers' aid in the construction of Maury CWS Plant at Columbia, Tennessee, the Nashville District was also assigned this task.[21]

Two of the largest military projects built by the District were troop cantonments at Camp Campbell (Kentucky-Tennessee Armored Division Camp) and Camp Forrest.

The Camp Campbell project (Fort Campbell), located on both sides of the Kentucky-Tennessee state line north of Clarksville, required the acquisition of over 100,000 acres of property, the construction of 100 miles of road, and the erection of housing for 35,000 men. Other figures were just as staggering—116 motor repair shops, 288,000 square



Picturesque Center Hill Dam and Lake on Caney Fork River.

Towboat *Irvin Cobb* delivering a big load of military trucks on the Tennessee River in 1943.

feet of warehouse space, 349,692 square feet of vehicle storage space, and a 1,254 bed hospital. Thirteen thousand workers constructed the original camp in about a year, but additional facilities, such as the Clarksville Air Support Command Base, were later added.[22]

Camp Forrest, originally Camp Peay, near Tullahoma, Tennessee, was constructed by the Hardaway-Creighton Company, a joint-venture firm, during the fall and winter of 1940-41. The Quartermaster Corps directed the original work, but entry of the United States into the war in late 1941 necessitated enlargement of the camp and the addition of related facilities such as the Spencer Artillery Range and the Tullahoma Air Support Command Base by the Engineers.[23]

In the vicinity of Nashville the Engineers had several projects under construction simultaneously. The Air Corps needed barracks for training men to service the Vultee "Vengeance" Bombers near the Vultee Aircraft plant. The Nashville District had quarters ready for the trainees after a mere thirty-day construction period. This was accomplished by moving CCC barracks ninety miles to the site, thereby conserving time and critical materials.[24]

On March 5, 1942, construction of the Berry Hills Air Crew Classification Center near Nashville was authorized, with the primary criterion being speed, for it was ordered that the center be open for use by 9,076 officers, cadets, and enlisted men by July 15, 1942. The Nashville District made verbal contract with the architect-engineer firm, Warfield and Keeble of Nashville; and the O.C.F. Company, which united three construction firms for the task, erected an average of 12 buildings per day—totaling 696 buildings: barracks, mess halls, fire halls, warehouses, recreation buildings, a chapel, theater, post exchange, and other structures. The Air Corps moved into its classification center fifteen days ahead of schedule.[25]

Construction of a Bombardment Air Base near Nashville was ordered by the War Department on December 22, 1941, and the Engineers selected a site near Smyrna in Rutherford County, Tennes-

Many Nashville District employees were called to active duty at the onset of the Second World War.

see. Again, speed, not permanency or economy, was the primary criterion for the project. When power machinery did not move the work as speedily as desired, the Area Engineer hired mule teams and drag scrapers, manned by journeymen mule skinners, to get the job done. Six thousand workers had the project ready for use by the Army Air Corps on July 1, 1942. Two hundred buildings and tremendous air strips furnished facilities for 100 four-motor bombers to train crews for their tasks in the skys over Germany and Japan. B-17 and B-24 bombers were soon roaring over the Cumberland Valley on practice runs. This Air Base was deactivated after the war, but post-war complications reopened it under the new name of Sewart Air Force Base, in honor of Major Allen J. Sewart of Nashville who died in action in the Solomons. The Nashville District constructed numerous additions to this facility over the years.[26]

By the end of 1942 the construction job in the United States had passed the crisis stage, and the Army Engineers were increasingly concerned with their overseas military mission. General Eugene Reybold, Chief of Engineers, declared that by 1943 the Engineers could "move the Army and the Air Forces any damned place there were Germans and Japs left to destroy, whether it meant building a truck road around the Himalayan Hump, rebuilding the wrecked ports of Italy, or ferrying heavy tanks across the flooded river. We were the men who could do it because, by God, we were getting it done."[27]

General Douglas MacArthur once described the global conflict as an "engineer's war," and there was much reason for this description, for in addition to the enormous construction program on the homefront there were extensive engineering activities in the theaters of war and the feats of the combat engineers became almost legendary. Troops moving up in the drive to Berlin and Tokyo were frequently confronted with mocking signs left behind by the Engineers, that read: "You cross this river with dry feet, courtesy, U. S. Engineers!"[28]

But the story of the combat engineers lies outside the history of the Nashville

District and has been told well elsewhere. Also outside of the history proper of the Nashville District, but still germane, because it occurred with the District's boundaries and with the cooperation of District personnel in some instances, is the story of two highly classified, special Engineer Districts, one near Kingsport and the other at Oak Ridge, Tennessee.

The Holston Ordnance Works, for which the special Kingsport Engineer District was created, involved construction of a hundred million dollar plant for the assembly-line, mass production of the superexplosive RDX. "Composition B," a combination of RDX and TNT, armed the depth charges which blasted the U-boats of the Third Reich out of the Atlantic and the blockbusters which rained down on Germany and Japan day and night. It was the most powerful explosive known to man until the events of August 6, 1945, publicized another.[29]

Personnel of the Nashville District were involved in some of the work at the Kingsport project, and Nashville District

Recruits departing in 1943 from Union Station, Nashville.

Combat engineers bridge the Cumberland River during 1943 maneuvers.

Engineers W. A. Davis and Reading Wilkinson also commanded the Kingsport District at various times. Holston Ordnance Works constituted a then totally new concept in the production of high explosives. It was actually a complex of two plants, one for processing raw materials and the other for manufacturing RDX and combining it with TNT, plus auxiliary features, all tied together by a network of railways and pipelines. The massive size of the project and the sensitive nature of its mission made construction difficult, but it was successfully accomplished, and the ten production lines of the complex achieved a total output of 434,000 tons before the end of the war, drove the cost of destruction appreciably downward, and made a significant contribution to the Allied war effort.[30]

During the summer of 1942, citizens of Anderson and Roane counties, near Knoxville, Tennessee, were mystified by the presence of strangers, some khaki-clad, who carried surveying instruments. When asked what they were surveying for, the reply was quick: "75 cents an hour." The complete answer to this question was not to be revealed for three years, and in the meantime strangers thronged into the hills and a new town, Oak Ridge, mushroomed overnight. By early 1943, the Engineers had completed acquisition of land for the Manhattan District and a gigantic complex of industrial might began to rise, built by 47,000 men under the lash of hard-nosed Engineers. By 1945, 82,000 men were engaged in the construction, maintenance,

and operation of the Oak Ridge project, very few with any idea what they were really doing.[31]

They found out what they were doing, as did Japan, on a very hot day in August 1945. A few tense days later, on board the Battleship *Missouri* in Tokyo Bay, General MacArthur accepted the surrender of the Empire of Japan, and witnessing the event was a representative of the Nashville District, Colonel Orville E. Walsh, who had initiated the District's military construction mission five years before. Colonel Walsh stood in the hot sun on the deck of the *Missouri*, mentally reviewing the war and thinking of the people who had helped him, and, when the formalities were concluded, he smiled.[32]

Over ten billion dollars worth of construction, a substantial portion of it in the Nashville District, was accomplished by the Corps of Engineers during World War II. Ruthless pressures forced hasty and impermanent construction on many military projects, but speed and serviceability in time of war was just as important as economy and durability on peacetime civil works projects.[33]

The Cumberland River, thanks to the A-Frame wickets installed before the war, made its own contribution to national defense during the conflict, along with the other inland waterways of America. The rivers relieved the overtaxed railway system of the necessity of transporting many bulk commodities, especially petroleum, provided a waterway network free from submarine attack, and fostered a wider distribution of war industry, away from the crowded and more exposed coastal regions. Over 4,000 landing craft and small ships were constructed on the inland waterways during the war and floated down the rivers for use overseas. Some were built on the Cumberland and moved down the river system to the Gulf, though in some cases the ships were so large that a "wave" had to be created by lowering the A-Frame wickets to float them over the shallower portions of the channel.[34]

The American people had high hopes in 1946 that peace would be their delight-

Many warships were built on the inland rivers during the Second World War.

Combat engineering in Burma in 1944 was a combination of the old and the new.

ful lot for many years to come, but disillusionment was not long in coming in the form of an "Iron Curtain" and a nerve-grating Cold War. Hence, the Nashville District was able to devote its attentions to the Cumberland for only a few fleeting years before the defense of the nation again brought a military mission to the District.

Even during those years, the Corps of Engineers continued a military mission within the Nashville District at Tullahoma, Tennessee, to meet the engineering requirements of the Air Force. A special Tullahoma District was established on November 14, 1949, with the mission of designing part and constructing all of the Arnold Engineering Development Center, named in honor of General "Hap" Arnold of the Air Force. Until the Tullahoma District was placed in the South Atlantic Division in 1951, the District Engineer had all of the authorities held by a Division Engineer,

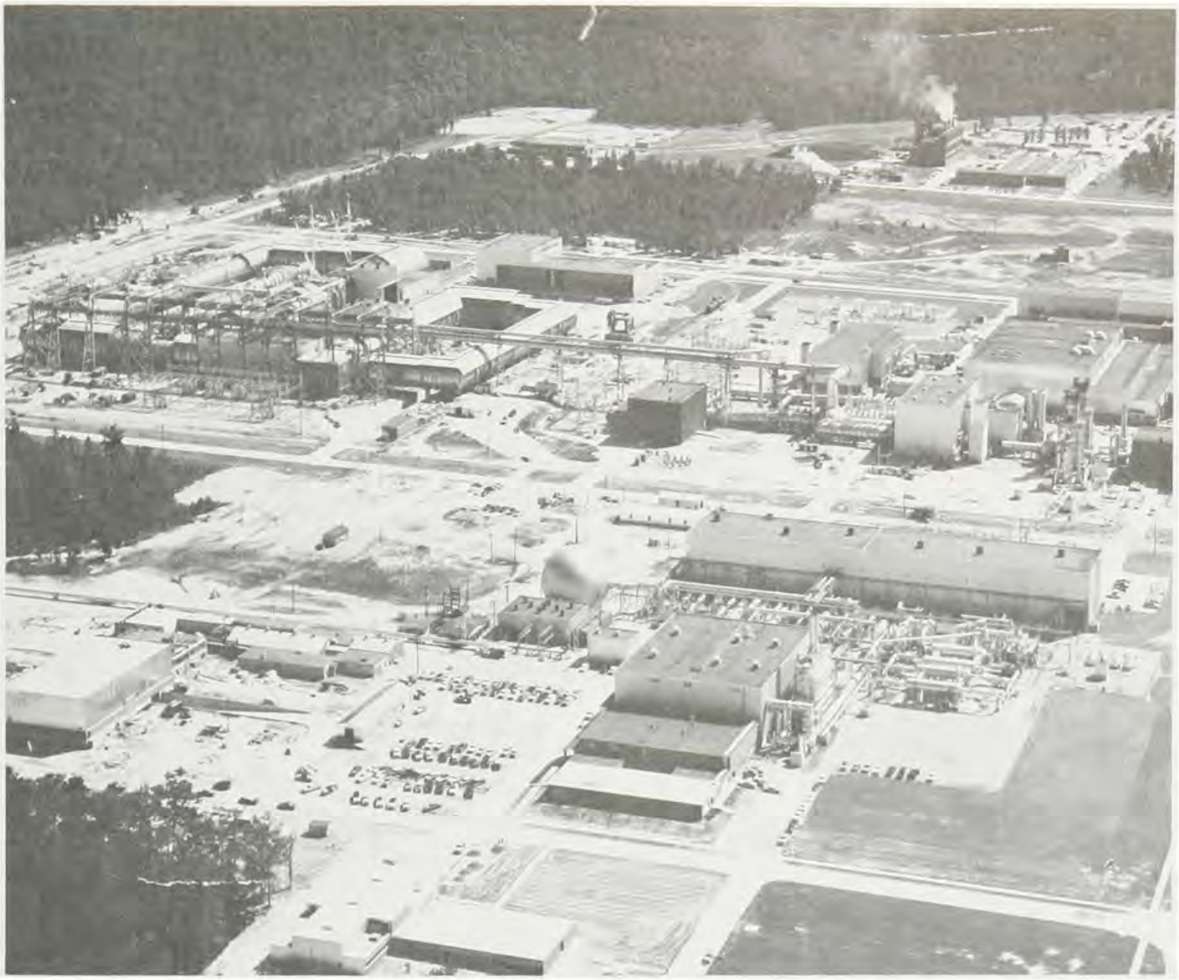
Nashville District's plans for the Veterans Administration Hospital at Chattanooga.

reporting directly to the Chief of Engineers.[35]

German and Japanese equipment-testing devices were brought to the United States and installed at Tullahoma; these, plus American engineering and equipment, produced the largest aerodynamic testing complex in the world. The complex included a jet engine testing unit, a gas dynamics unit (supersonic and hypersonic wind tunnel group), and a propulsion wind tunnel to duplicate atmospheric, temperature, and speed conditions on the ground for the testing of military and civilian aviation equipment. It was another project of prodigious dimensions. Two 83,000 horse power, twelve pole, synchronous motors in tandem, the largest electric motors ever constructed at the time, delivered power to whirl giant fans, capable of producing an air flow equivalent to the requirements of 350 F-80 fighter planes at full power. When in operation, the project required electric power equal to that required by a city of 100,000 population at peak load, and to produce the extreme temperatures for testing a water flow of 100,000 gallons per minute was necessary (a rate equal to that required by a city the size of Washington, D. C.). The Tullahoma District constructed Elk River Dam (Woods Reservoir) on nearby Elk River to meet the latter requirement. The Elk River project involved construction of a 90-foot high, 3,000-foot long dam, with a reservoir area of 5,120 acres. Elk River Dam was completed in 1952.[36]

Before its amalgamation with Nashville Engineer District in 1960, the Tullahoma District constructed facilities which made important contributions to American civilian and military aerodynamic engineering and an as yet unassessed contribution to the success of the United States in the space race.

When the Cold War waxed hot in Korea, the reactivation of the Nashville District's military mission was ordered in 1951, and the direction of military construction activities in the State of Tennessee and at Fort Campbell, Kentucky, was returned to Nashville from other districts (Mobile, Savannah, and Louisville) which had administered the pro-



Aerial view of Arnold Engineering Development Center in 1959. It was built by the Tullahoma Engineer District.

gram from 1945 to 1951. The civil works organization of Nashville District was again mobilized for military construction and rapidly hit its old stride, reaching a peak workload of $33,000,000 in military jobs during fiscal year 1954. The District directed construction at Air Force installations, notably Sewart and McGhee-Tyson Air Force Bases, and at Army projects such as Wolf Creek Ordnance Plant at Milan, Tennessee; Volunteer Ordnance Works, Chattanooga; Holston Ordnance Works, Kingsport; Memphis General Depot; and Fort Campbell, Kentucky-Tennessee. There was some totally new construction, but most involved enlargement and rehabilitation—"retreading"—of previously constructed installations.[37]

The end of active hostilities in Korea was followed by gradual tapering of the District's military work, although in some years expenditures in the District for military construction exceeded those for civil works. For example, in 1956 expenditures were greater at Fort Campbell alone than expenditures on all civil works projects in the Cumberland Basin. Nevertheless, by 1959, a hiatus in the Cold War, among other factors, had tapered expenditures for military construction in the Nashville District to $5,000,000.[38]

A rather confusing chain of command was in effect during these years, for the Nashville District was under the jurisdiction of the Ohio River Division in its civil works activities and under the South Atlantic Division in its military activities, but the District Engineers appear to have experienced little difficulty in dealing with the situation. One declared in 1960:

"Despite the Biblical statement that no man can serve two masters, the system has worked surprisingly well and has proven to be economical. I have experienced little difficulty in aligning our work under two separate chains of command."[39]

Although District personnel did not find the two separate chains of command confusing, they were mystified by events of 1960 and 1961, because the District's military mission was greatly augmented in 1960 and then, less than a year later, military construction was transferred in its entirety to the Mobile District.

The Tullahoma District had become an area affice of the Nashville District on July 1, 1960; it constituted an enormous increase in the scope of Nashville's military mission, for rocket engine test cells were under construction at AEDC. But, effective May 1, 1961, military construction and real estate responsibilities were transferred from Nashville to Mobile Engineer District in the interest of economy. The District was one of twelve across the nation which lost their military mission in 1961 as a result of a reorganization aimed at saving $13,000,000 annually and 1600 jobs. There was even thought at the time of converting Nashville to an "operating district" with a modified civil works mission, but the Chief of Engineers rejected this view.[40]

The news of the transfer of the direction of military construction activities out

Combat Engineers build a bridge in Korea, 1951. Note the log crib pier.

Roll of Honor listing Nashville District personnel in military service in 1943. It was displayed in the Federal Customs House.

of the twin valleys was greeted with a great lack of enthusiasm on the part of the people of the region and District personnel, particularly those whose jobs were to be part of the "savings." Nearly 150 employees at Nashville came under the latter classification, and, though every effort was made to absorb this highly trained surplus personnel by transfer, many were lost to other agencies and to private business. No doubt centralization of the military mission did result in considerable savings; on the other hand, decentralization was historically an important asset of the Engineer organization, enabling it to maintain close communication with the citizens of each district and allowing rapid mobilization of local resources in an emergency.[41]

A vivid example of the value of the Corps decentralized organization was provided in 1961 when President John F. Kennedy urgently requested speedy action on civil defense and fallout shelter programs. The task was assigned to the decentralized district organization of the Engineers, which was in close contact with local authorities and well acquainted with the situation in each dis-

Dam and reservoir on Elk River built by Tullahoma Engineer District to supply water to Arnold Engineering Development Center.

trict. The Engineers also had an established reputation for dealing with emergency conditions effectually, for each district, Nashville included, had often participated in flood relief and other disaster operations.[42]

It was this record which brought the Engineers the responsibility for the emergency Civil Defense program of 1961. The Nashville District was given the responsibility for seventy-five counties in Middle and East Tennessee, and it cooperated with local Civil Defense officials in locating and marking hundreds of fallout shelters. It made arrangements with radio stations to join in a nationwide Emergency Broadcast System, prepared a construction equipment inventory, and developed Community Shelter Plans for metropolitan areas. Over one hundred million shelter spaces were located and marked across the nation by the Engineers for use in a national emergency, and plans were prepared in each district and division for vital post-attack operations: debris clearance, repair of transportation and utility lines, radiation detection, damage assessment, and mass burials. This was one project the Army Engineers prayed they would never be forced to undertake.[43]

The Civil Defense mission went also to the Mobile District in 1968, and loss of the Nashville District's military mission appeared to be permanent, but personnel of the District remain proud of their contributions to the success of American arms. As they were in 1941, they remained prepared for any demands which the future may hold, whether civilian or military in nature, and were confident they could get the job done.

CHAPTER XII

COMPREHENSIVE CRESCENDO

Defeat of the Axis Powers in 1945 permitted renewal of construction of the Nashville District's multipurpose projects in the Upper Cumberland Basin, which had been deferred because of the pressures of the military mission. Project plans were modified, because during the course of the war Congress had enacted landmark legislation which authorized new project purposes and permitted full consideration of additional benefits in project planning.[1]

The historic Flood Control Act of 1944 defined national policies for the development of recreational facilities at Engineer projects and authorized construction, maintenance, and operation of parks and recreational facilities in reservoir areas; it recognized the rights of state governments in water resource development programs by requiring the review of project planning by the governors of the states affected before submission to Congress; and it directed that the hydroelectric power generated at Engineer projects be delivered to the Interior Department for disposal in a manner which would encourage widespread use of electric power. Under the latter provision, power developed at Cumberland Basin projects was delivered to the Southeastern Power Administration, an agency of the Interior Department, for distribution.[2]

Since Dale Hollow Dam had been completed for flood control purposes before the suspension of construction in 1943, it was first of the three multipurpose projects in the Upper Cumberland Basin to be completed. Flatboats, coal boats, and log-rafts had once navigated Obey River and its tributaries East Fork, West Fork, and Wolf River, and small steamboats had actually navigated the river as far upstream as Eastport at the juncture of East and West Forks, but this traffic had ended by 1940 and Dale Hollow Dam and Lake put the river to different uses. The generating units at Dale Hollow (three of 18,000 kw each) began delivering power to the Southeastern Power Administration in late 1948, producing 93 million kilowatt hours during the fiscal year—the first hydroelectric power generated at an Engineer project in the Cumberland Valley.[3]

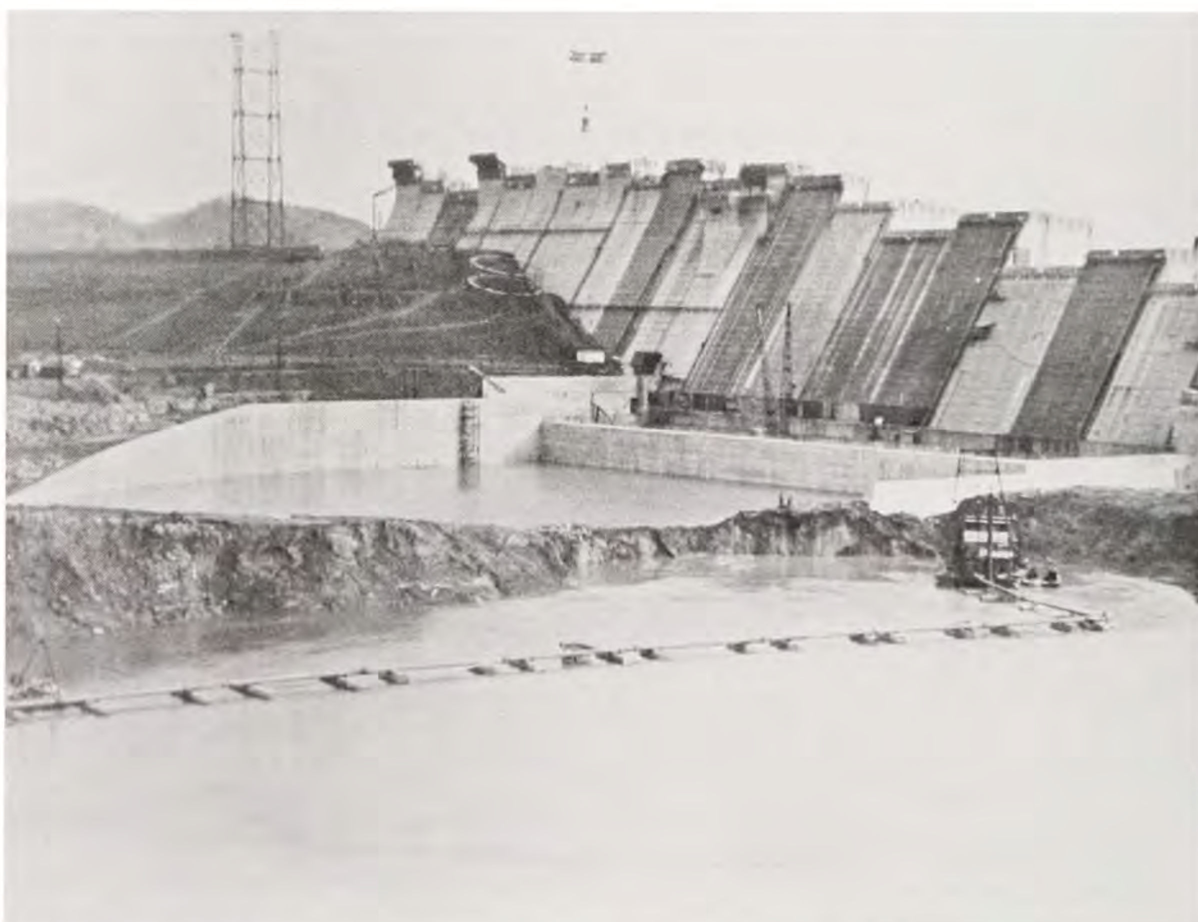
Center Hill Dam on the Caney Fork River was the second of the three projects to be completed. The dam was closed on November 27, 1948, and its power generating units (three of 45,000 kw each) went on the line in 1950 and 1951. Center Hill Lake established deep water pools on Caney Fork River to a point near the Great Falls at Rock Island, Tennessee, once the head of navigation for flatboat, log-raft, and steamboat traffic. The Engineers had once improved the same stretch of river for navigation. The project at Center Hill actually involved construction of two dams, because an earthfill dam was also constructed across a "saddle" near the main dam.[4]

Because the Flood Control Act of 1944 recognized the value of the recreational benefits to be derived from Engineer reservoir projects, both Dale Hollow and Center Hill were credited with benefits not included in the original calculation of project benefits, and a precedent-setting reservoir management program was instituted at the two projects. The program

involved shoreline sanitation, malaria control, conservation and land management, and the operation and maintenance of public use facilities. Both projects, indeed all reservoir projects subsequently constructed in the Cumberland Basin, were soon serving an unexpectedly large number of visitors seeking the pleasures and relaxation of water sports, and the fishing was fine! As early as 1954, Dale Hollow Lake was voted the "best fresh-water fishing spot" in America by *Fisherman* magazine.[5]

The towering mass of concrete astride the Cumberland at Wolf Creek, completed in 1952, involved the Nashville District in its first large-scale relocation problem, for Burnside (old Point Isabel), Kentucky, once an important steamboat port, was inundated by Wolf Creek Reservoir. The Engineers originally planned to relocate residents of the town in other nearby communities, but the intensely loyal citizens of Burnside demanded the town's existence be continued at a new site, and the Engineers yielded to their requests, though the relocation of the town meant an increase of eighteen per cent in relocation costs to the United States.[6]

This increase in relocation costs, the addition of power production as a project feature after the original estimates had been made, a substantial increase in real estate prices, and the discovery that the rugged terrain of the region made it more economical to purchase large tracts of land than to purchase rights-of-way and build access roads to the banks of the reservoir resulted in a large increase in the costs of land acquisition at Wolf Creek over the 1937 estimates.



Wolf Creek Dam under construction on December 9, 1948. Contractor dredge in foreground.

Interior of powerhouse at Wolf Creek Dam, Cumberland River.

The District was castigated for the disparity between the original estimates and the actual costs, but subsequent events justified the District's action. Wolf Creek Reservoir, appropriately renamed Lake Cumberland by act of Congress in 1952, soon became one of the top-ranking Engineer reservoir projects in the number of visitors who came to enjoy the scenic beauties and recreational opportunities the lake provided.[7]

Other reservoir projects, built under more restrictive land acquisition policies, experienced numerous difficulties in maintaining proper shoreline sanitation and water quality, while conflicts between private property owners along the shore and recreationalists were persistent. But Lake Cumberland was not afflicted with these problems to any great extent, although subject to some of the heaviest recreational use in the nation.

Alben Barkley at the Wolf Creek Dam dedication ceremonies, 1951.

The gigantic dam at Wolf Creek, more than a mile in length and 240 feet in height, impounded the fifth largest volume of water in the United States when it was completed. Much of shimmering Lake Cumberland averages a hundred feet deep and just above the dam it reaches the depth of 200 feet. Enough water is in storage behind Wolf Creek Dam to cover the entire Commonwealth of Kentucky to the depth of three inches.[8]

Vice President Alben Barkley, when he dedicated the Wolf Creek project in 1951, was more impressed by the hydroelectric features of the development. "Almost noiselessly, the clear waters impounded here will surge through the giant turbines below this 240-foot dam, pouring forth from its generators an endless stream of electric power," proclaimed the Veep, in his stentorian tones. "That power," he continued, "will go into plants that are devoted to the very preservation of our lives, and our way of living."[9]

The Nashville District completed Wolf Creek just in time to join Dale Hollow and Center Hill in operations to alleviate damages during the flood crisis of early 1951. The three projects averted extensive damage to the Cumberland Valley below by reducing the crest of the flood by thirty feet at Celina, twenty and a half feet at Carthage, eleven feet at Nashville, and twelve and a half feet at Clarksville. Two years later the three projects prevented a record low water stage in the Cumberland River by regulating releases of reservoir waters to augment the river's natural flow. Under natural conditions, the minimum monthly average flow of the river past Nashville would have been only 300 cubic feet per second (cfs), but the projects were able to maintain the flow of the river at 2,500 cfs, with immense benefit to the valley's water supply, water quality, and river commerce. Comprehensive development was beginning to pay the dividends planned by the Engineers.[10]

While the flood control-power projects authorized for the Upper Cumberland

Wolf Creek Dam and Lake Cumberland

Valley under the comprehensive plans for the Ohio River Basin were under construction, the Nashville District was not neglecting the Lower Cumberland Valley. Burgeoning commercial traffic on the Lower Cumberland was greatly hindered by the limited depth and size of the locks and dams constructed in the canalization project for steamboat traffic prior to 1924, and in 1945 the District proposed creation of a nine-foot minimum channel depth with modern locks for the Lower Cumberland. Two alternative plans were prepared for a nine-foot project: one calling for three moderate height dams at Eureka (Kuttawa), Dover, and Cheatham sites for the benefit of navigation alone; the other providing for multipurpose development. The latter plan called for the construction of a navigation dam at the Cheatham site and a multipurpose dam at the "Lower Cumberland" site.[11] The Nashville District and the Ohio River Division, after study of alternatives, concluded it would be in the best interest of the valley and of the nation to adopt the multipurpose plan and so recommended. But the plan for a high, multipurpose dam on the Lower Cumberland met with vigorous and articulate opposition.[12]

High, multipurpose dams had many important benefits. They created deep channels in which towboats operate best and reduced the number of lockages; thus, they facilitated regular schedules for waterborne commerce and reduced the amount of motive power required for large tows, lowering the costs of transportation and, hence, the cost of the product the consumer purchased. Multipurpose projects provided flood control

and water-flow augmentation to level out the fluctuating heights of rivers; they produced hydroelectric power for industries and communities; and they promoted recreational usage by fishermen, pleasure boaters, and others who seemed naturally attracted by large bodies of water.[13]

At the same time, multipurpose projects had several disadvantages. High dams permanently inundated fine farm lands in river bottoms; they submerged low-land villages and towns, dislocating the population; at times they covered sites of historic or scenic beauty; they could divide local governmental units and impair their tax base; and they could, if not properly managed, contribute to the propagation of insects and the diseases they carry.[14]

The latter arguments prevailed in the Lower Cumberland Valley in 1946, and citizens' organizations vehemently protested construction of a multipurpose dam at the Lower Cumberland site. The Board of Engineers for Rivers and Harbors conducted hearings on the project and was impressed by this vocal opposition and by the objections of the governors of Kentucky and Tennessee. The Board reported the Lower Cumberland Dam "would inundate large areas of good farm land, require the relocation of the towns of Kuttawa and Eddyville, and necessitate extensive . . changes in the vicinity of the dam site. Information secured by the Board indicates that the inhabitants of the valley . . are strongly opposed to the taking of their homes and lands for the purpose of developing water power." It concluded the need for hydroelectric power did not outweigh arguments against a high dam and recommended the construction, instead, of the three low dams in the alternative plan. The Chief of Engineers concurred with the Board and so did Congress, which authorized a nine-foot channel on the Lower Cumberland in 1946 to be obtained by the construction of three moderate height dams at Eureka (Kuttawa), Dover, and Cheatham sites.[15]

Under this Congressional directive, the Nashville District began construction of the uppermost of the three dams at the Cheatham site in 1950. After a struggle

The old Cumberland River locks were too small for barge-tow traffic.

between advocates of public power and proponents of private power, the additional feature of hydroelectric power production (three units of 12,000 kw each) was authorized for the Cheatham project, made possible by improved efficiency in "low head turbines" and an increase of five feet in the depth of the pool behind the dam. The Nashville District dedicated the project in 1954 in honor of Confederate General Benjamin F. Cheatham. Power produced at the Cheatham project went on the lines in 1959 and 1960, and recreational facilities around the reservoir were developed.[16]

In addition to three moderate-height dams on the Lower Cumberland, the Rivers and Harbors Act of July 24, 1946, also authorized construction of three dams—Old Hickory, Carthage (Cordell

Locking multiple barge tows at the old Cumberland River locks was a lengthy process

Aerial view of the Cheatham Lock and Dam project under contruction during the March 1955 Cumberland River flood.

On September 4, 1957, Unit 4 rotor was lowered into place for power production in the generator room of the Old Hickory Dam power plant.

Construction inside the cellular cofferdam at the Old Hickory project on the Cumberland River.

One of the busiest recreation areas in the Nashville District is the beach near Old Hickory Lock and Dam.

Hull), and Celina dams—on the Upper Cumberland between Nashville and the Wolf Creek project.[17] The District began construction at the Old Hickory site named for the Cumberland River President, in 1952, with plans to work its way up to Wolf Creek as funding permitted. The navigation lock at Old Hickory Dam was placed in temporary operation in 1954 and permanent service in 1956, providing a nine-foot channel to Carthage, Tennessee, and power generation at the dam (four units of 25,000 kw each) began in 1957.[18]

Although recreation was not an authorized project feature at Old Hickory, the reservoir, because of its proximity to Nashville, soon became one of the greatest centers for water sports in the nation. It seemed the entire population of the Nashville area migrated like lemmings into the cool waters of Old Hickory Lake on hot summer days. The Engineers soon recognized that Old Hickory alone was inadequate for the needs of the rapidly-growing urban area, and they began planning recreational features into the Stewart's Ferry project (J. Percy Priest Dam and Reservoir) on Stone's River.[19]

Thus, in 1954, the District had moderate-height navigation-power dams in operation at Old Hickory and Cheatham, above and below Nashville on the Cumberland, and was planning two more such dams between Old Hickory and Wolf Creek projects on the Upper Cumberland and two between the Cheatham project and the mouth of the river. But the controversy on the Lower Cumberland over the construction of two moderate height dams, as opposed to the construction of a single, high, multipurpose dam, was still in progress.[20]

Vehement local opposition, the disapproval of the governors of both affected states, and the lack of a clear demand for hydroelectric power had brought about the recommendation of the Board of Engineers and the Chief of Engineers for two navigation dams on the Lower Cumberland in 1946. The Nashville District, however, which had supported multipurpose development in 1946, still maintained this was the best plan. The District Engineer pointed out in 1951 that in

Old Hickory Lock and Dam.

merely five years regional demand for hydroelectric power had increased approximately eighty-three per cent.[21]

The Federal Power Commission and the Tennessee Valley Authority agreed with the Nashville District, but fervent opposition still persisted in the Cumberland Valley, most notably from the Lower Cumberland Valley Association (LCVA). This association fiercely fought legislation designed to place the development of the Cumberland River under the direction of the Tennessee Valley Authority and was absolutely opposed to the construction of any high dam on the Lower Cumberland.[22] Some proponents of the extension of the Authority's powers into the Cumberland watershed accused the LCVA of having nefarious motives, other than preventing the inundation of farm lands. Allegations were made that the LCVA had private electric power companies and coal interests behind it. The president of the LCVA responded that the members of the Association had observed the developments around TVA's Kentucky Lake and found them lacking. "They see," he said, "that these developments consist of a few hot dog stands, boat docks, and some accommodations for tourists. They do not consider that a fair exchange for the thousands of acres of farm lands drowned, communities wiped out and families scattered. They resent the implication, so frequently made, that their protests are inspired by the power trusts."[23]

On the other hand, there were many proponents of a high dam on the Lower Cumberland, most notably Pollard White, a community leader in the Cadiz-Trigg

County, Kentucky, area, and Nat Caldwell, a staff writer for the Nashville *Tennessean*, who canvassed the valley persuading its citizens that the high-dam project would be in their best interests. At the same time, the demand for electric power continued to climb steeply upwards and waterborne commerce on the Cumberland River, in spite of antiquated locks and six-foot channel, increased fifty per cent in five years. In 1952, the Board of Engineers held a second hearing on the Lower Cumberland project. Testimony presented at that hearing was predominantly favorable to a high dam, multipurpose project, and both the Commonwealth of Kentucky and the State of Tennessee retracted their previous objections.[24]

Typical of the testimony the Board heard was that of a farmer from Golden Pond, Kentucky (once a nationally-known center for the production of illicit whiskey). He testified that river-bottom farming had become very difficult:

> Recurring overflows have made it practically impossible to count on harvesting a crop. For that reason most of the money spent on farm research has been spent on improving upland farming. We river-bottom farmers haven't gotten much out of farm research as far as adding value to our property is concerned.
>
> Therefore, we feel that a high dam will be better for us than a low one. We would rather be flooded and have our land taken from us and go relocate somewhere than be sitting there with a low dam and water-soaked so we can't get anything out of it and can't get rid of it.[25]

The Board of Engineers rescinded its recommendation of 1946 and concluded: "Changed conditions since the authorization of the existing project for Cumberland River, Tennessee and Kentucky, substantiate the need for multi-purpose improvement on the lower Cumberland River . . . in lieu of the presently authorized Kuttawa and Dover improvements for navigation only." Congress accepted the Board's new recommendation and, in 1954, authorized substitution of a single high dam for the proposed dams at Kuttawa and Dover. It also approved construction of a canal between Kentucky Lake and the reservoir to be created on the Lower Cumberland

The Old Cumberland River locks went out with a bang. This explosion cleared the Cumberland of Lock C, clearing the way for traffic on Lake Barkley.

to afford integrated operation of the two reservoirs and alternative routes for navigation.[26]

A petition requesting a speedy construction start at the Lower Cumberland site, signed by 10,000 Kentuckians, was presented to Congress in 1955 by Senators Clements and Barkley. Congress honored the latter, the beloved "Veep" of Paducah, in 1956 by giving the names Barkley Dam and Lake Barkley to the Lower Cumberland project.[27]

The Engineers were very anxious to alleviate the extensive problems of relocation at the Barkley project, and they investigated a dam site above the towns of Kuttawa and Eddyville, Kentucky, which would have prevented their inundation by the reservoir. But the alternate site was found to have unsatisfactory foundation conditions, in addition to other problems, and was rejected.[28]

Relocation and land acquisition was an extremely sensitive business, arousing more public resentment than probably any other activity of the Engineers, or for that matter any other agency which exercised eminent domain. Just compensation for private property taken for public use was guaranteed by the Fifth Amendment to the Constitution of the United States, but differences of opinion arose when attempts were made to determine "just compensation." The Army Engineers did their utmost to arrange voluntary sales of property wherever possible—some eighty per cent of the lands inundated by Lake Barkley were acquired amicably—but at times

Barkley Lock and Dam

"just compensation" had to be determined by the courts. No matter how just the compensation, the relocation of families and businesses, often without their volition, for projects constructed for the benefit of the public in general can be heart-rending. Public sympathy has generally favored the man who must see the land of his fathers submerged beneath a hundred feet of water.[29]

The relocation problem at the old towns of Kuttawa and Eddyville, Kentucky, was accentuated by the difficulties the citizens had in settling the question of where the new towns would be located and by the fact that some of the people had been relocated from Kentucky Reservoir by TVA a decade or two before. There was a legend of a moonshiner who had been successively relocated from Smoky Mountain National Park, an East Tennessee reservoir project, the Oak Ridge site, and Lake Barkley pool. He was reputed to have said that he could deal with the "revenooers" if the other "govmint" agencies would just "leave him be."[30]

After lengthy and acrimonious disputes over the relocation sites of New Eddyville and Kuttawa, the removal was finally accomplished about 1960. Though some citizens could still be heard to lament the loss of their old home places, most became acclimated to their sparkling new towns and were emjoying a new prosperity. The Nashville District was very proud of the beautiful sites near Lake Barkley where the new towns were located, and the visitors who remembered the old towns usually admitted that pride was justified.[31]

Barkley Dam, a concrete gravity and

Barkley Canal under construction on March 31, 1966. Dredges are removing the canal plug.

earthfill structure almost two miles long, quickly formed a barrier across the Lower Cumberland and a great body of shimmering lake waters began to back up to Cheatham Dam. Barkley Lock

Nashville District Engineer Jesse L. Fishback presents Corps hardhat to Vice President Hubert Humphrey during the Barkley project dedication.

opened permenently to navigation in 1964, and the giant turbines (4 units of 32,500 kw each) began their steady rotation at 62.5 rpm in 1966, swishing in an inexorable cycle in the bowels of the dam to light the homes and twirl the machines of Mid-America.[32] The Engineers have at times been criticized for underestimating the costs of civil works. projects, but the Barkley project, by economies in design and favorable bids, was constructed at costs far below—over twenty million dollars below—the original estimates. Indeed, final costs of the project were almost forty million dollars below the cost estimated at the time construction was begun. Chief of Engineers Walter K. Wilson proudly declared the work of the Nashville District at the Barkley project vividly illustrated both the value of competitive bidding

and the ability of the Army Engineers to set the pace in modern design concepts.[33]

A spectacular feature of the Barkley project was the canal between Kentucky Lake and Barkley Lake which united the waters of the twin rivers, making them siamese twins. The canal was excavated through a section of the divide long known as the "Land Between the Rivers" at a point 2.2 miles above Barkley Dam, providing alternative and shorter routes for river navigation between the Cumberland, Tennessee, and Ohio rivers. Integrated operation of the Barkley and Kentucky reservoirs was made possible by the diversion of waters through the canal from one reservoir to the other. In actual practice, water through the canal generally flows from Kentucky Lake to Lake Barkley because of the greater volume of water in the Tennessee River, affording a more economical operation of the Barkley power plant.[34]

The Barkley project was dedicated by impressive ceremonies on August 20, 1966. Thousands gathered to watch Hubert Humphrey, Vice President of the United States, symbolically unite the twin rivers by pouring water from each river into an elaborate mixing bowl. The Vice President's dedicatory speech was disconcerting, however, for although he extended deserved praise to the Tennessee Valley Authority he failed to mention the Nashville District which had constructed the project. This, perhaps, may be explained by the extensive publicity which attended the "Land Between the Lakes" program of the Authority.

Lake Barkley State Park, a Commonwealth of Kentucky project and recreation mecca.

Nashville District executives in 1964, From the left: J. O. Hicks, Assistant Chief of Operations; A. E. Powell, Chief of Locks and Dams Branch; A. D. Thau, Chief of Operations; James B. Newman, District Engineer; F. P. Gaines, Chief of Engineering, A. E. Dykes, Chief of Planning and Reports Branch; and J. G. Williams, Jr., Chief of Survey Section.

Between the two reservoirs in Kentucky, the Authority established an unusual park for recreational and conservational purposes. It and the recreational facilities provided by the Engineers, the Commonwealth of Kentucky, and local governments on the right bank of Lake Barkley promised to convert the region into a water-sports enthusiast's paradise. Visitors were thronging into the area even before extensive public-use facilities were developed.[35]

Although the Nashville District's reservoir projects received much national publicity, there was little recognition for the work of the District in providing flood control projects for many small communities in the twin river basins which needed them, demanded them, and were willing to assume the requirements for local cooperation in the construction, operation, and maintenance of the facilities. This was unfortunate, because there was no better example of national and local government cooperation. Most local flood control projects in the twin valleys were constructed for communities located above the protection provided by reservoir projects. The first community to receive such protection was Middlesboro, Kentucky, just above the Tennessee line in Eastern Kentucky. It was protected by a channel-rectification project on Yellow Creek constructed prior to World War II, and additional protection was provided in 1952 by clearing the channel of Yellow Creek below the city. Further control was authorized, depending upon a favorable benefit-to-cost ratio.[36]

When disastrous floods repeatedly struck the mountain towns above Lake

Cumberland in 1946, 1951, and 1957, strong public support for local flood control projects developed in the area.

Pineville, Kentucky, nestled in the mountains on the banks of the Cumberland, had an authorized flood control project in 1937, but the local cooperation requirements were not fulfilled until after the flood of January, 1946 (maximum of record), inundated the unprotected city with calamitous consequences. Action swiftly followed: the House Committee on Flood Control directed reinvestigation of the Pineville project on March 1, 1946, and in April the city assured the Engineers that local cooperation requirements would be met. Pineville voted the necessary bond issue and construction began on a system of levees and concrete flood walls around Pineville and nearby Wallsend to protect against floods of the magnitude of 1946.[37]

By January of 1957 the project was nearing completion as the annual flood began to sweep down the Cumberland. Emergency conditions were soon reached, but Pineville was safe. Just eight hours before the river crested at Pineville the Engineers completed installation of pumping equipment and placed it in emergency operation. Corbin, Barbourville, Williamsburg, and other towns in the Upper Cumberland Valley suffered heavy losses; the region was declared a major disaster area by President Eisenhower and the Engineers and National Guard rushed into the area to conduct rescue-recovery operations. But the partially-completed flood control project at Pineville stemmed the tide, averting damages estimated at $590,000. After the waters subsided, civic clubs of Pineville expressed their gratitude by a vote of thanks to the Nashville District, and the town took over the operation and maintenance of the flood control works around the city.[38]

Barbourville, Kentucky, was not quite so fortunate. Although an Engineer flood control project was authorized for the Knox County town and was under construction, it had not progressed so far as that at Pineville. Sections of the levees which had been completed did divert the destructive currents of the flood and lowered the water level a certain extent,

The 1957 Cumberland River flood at Barboursville, Kentucky. The local protection project was then under construction.

averting damages estimated at $50,000, but the town suffered severely.[39]

After the flood disaster of 1946, Barbourville had recognized its need for flood protection and expressed its willingness to assume local cooperation requirements, but the Federal government did not provide funds for the project until 1950 and Barbourville did not sell the necessary bond issue until 1954. The project, involving construction of 17,000 feet of levees, which averaged 15 feet in height, short concrete wall sections, and five pumping stations, was under construction from 1955 to 1959, since which time it prevented serious damage to the town on several occasions.[40]

Two other Upper Cumberland towns also participated in Engineer flood control projects: Cumberland and Corbin, Kentucky. The city of Cumberland is located on the Poor Fork, about twenty-three miles above its juncture with Clover Fork to form the Cumberland River. In 1950 a project designed to provide flood protection by clearing and rectifying the channel of Poor Fork to increase its carrying capacity was authorized. Citizens of Cumberland, with characteristic independence, constructed some of this work themselves without expense to the United States, but the record flood of 1957 in that area made it clear that additional protection was necessary. Plans in 1975 called for excavation of the channel of Poor Fork and of two tributary streams to such an extent that they could carry enough flood water to prevent

Local Flood Protection Project at Corbin, Kentucky, during construction.

Aerial View of local protection project at Lake City, Tennessee.

approximately ninety per cent of the average annual flood losses at Cumberland, but construction was delayed pending the availability of lands to be provided by the City of Cumberland.[41]

Corbin, Kentucky, on Lynn Camp Creek, a tributary of the Laurel River which empties into Lake Cumberland, was perennially inundated by the creek until the Nashville District went to work. A project was authorized in 1960 and Corbin met local cooperation requirements in 1962. By 1964 the Engineers had sliced a channel for Lynn Camp Creek capable of passing flows up to three times as great as its previous capacity without significant property damage.[42]

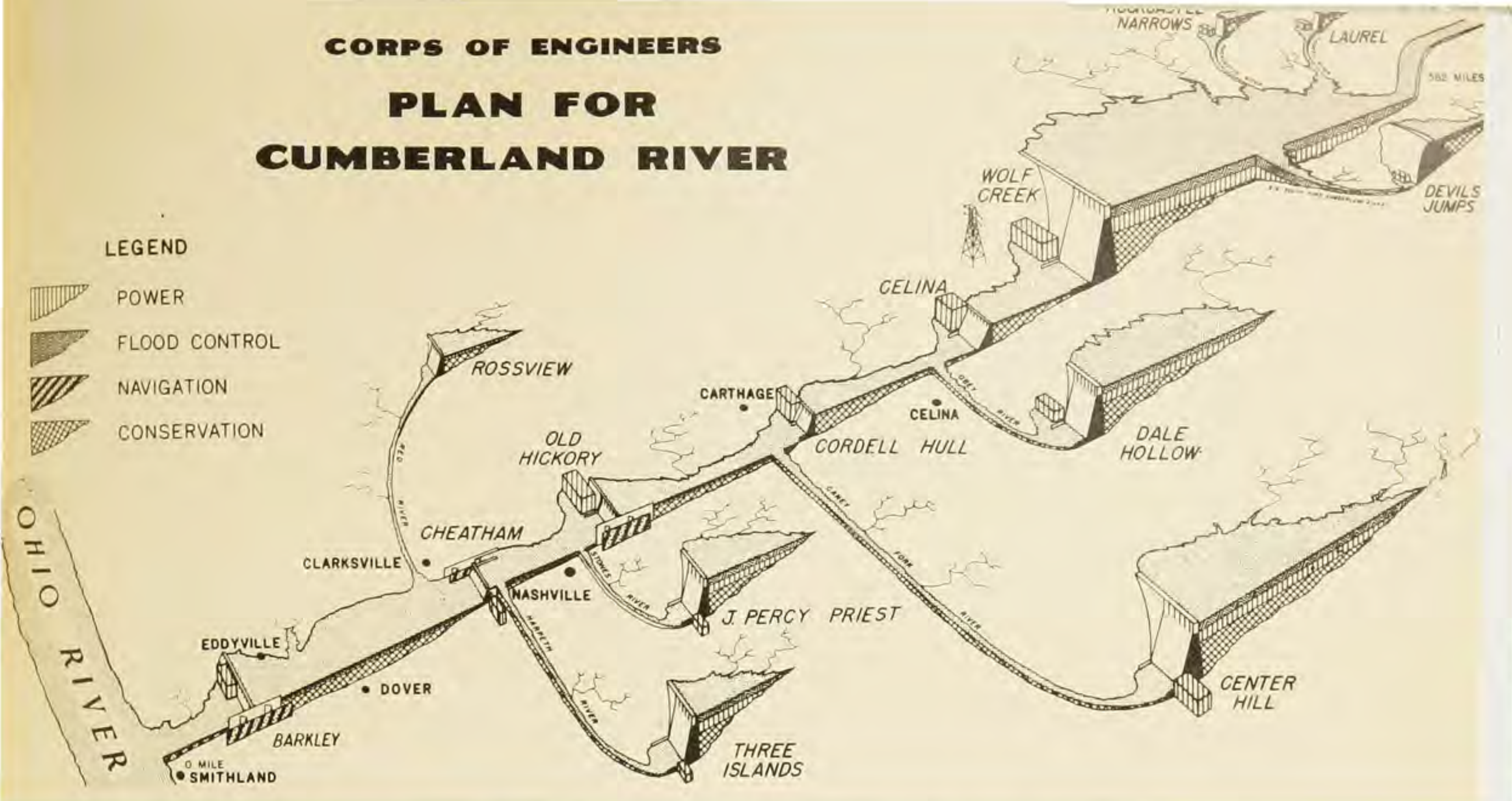
Congress authorized several other local flood protection projects for the Upper Cumberland Basin, but action awaited the acceptance of local cooperation requirements. Plans were in effect for projects on Crummies Creek at Cawood, Kentucky, and on Yocum Creek and Clover Fork near Evarts, Kentucky, but they could not be undertaken until all local requirements were fulfilled.[43]

The Nashville District also constructed three local flood control projects in the Tennessee River watershed. The first was Lake City, Tennessee, in Anderson County near Norris Dam, which was afflicted by serious flooding problems by Coal Creek, tributary of the Clinch River. The Engineers discussed the problem with the city council of Lake City in 1949, and the council expressed its willingness to cooperate in the project, arranging for the enactment of legislation by the State of Tennessee to authorize the city to levy taxes to finance its share of the costs.[44] The Lake City project—to enlarge the channel of Coal Creek to the extent that a flood fifty per cent larger than the 1929 record flood could pass down the stream without great damage to property—was authorized by Congress in 1954 and Lake City met its responsibilities in 1957. The Nashville District completed the project in 1960 and turned it over to the city for operation and maintenance.[45]

In 1957, the little community of Spring City, Tennessee, on the Piney River which empties into Watts Bar Reservoir on the Tennessee, was inundated by the highest flood in its history. In 1958 the Nashville District was called upon to clear the Piney River channel of debris, boulders, and gravel bars to improve its water-carrying capacity, a work reminiscent of the Engineer operations of the nineteenth century, though executed for flood control and not for the improvement of navigation. This project was completed at a cost of only $22,116, and Spring City assumed the costs of lands, damages, and maintenance.[46]

The third project in the Tennessee watershed was of exceptional interest, because it involved the protection of agricultural property, rather than an urban area, from flooding. Paint Rock River, in Alabama, meandered south for sixty miles before emptying into Wheeler Reservoir about six miles below Guntersville Dam. The Paint Rock, which flows through Jackson and Madison counties, Alabama, was once navigable by Alabama law, and in fact was navigated by flatboats and keelboats transporting cotton and by floated logs, but use of the stream for navigation had been long forgotten by 1950. The Nashville District began planning the Paint Rock project in 1953, in conjunction with the Soil Conservation Service, Department of Agriculture. The Engineers were to clear the main stream of the Paint Rock and the lower reaches of its tributaries of snags, rocks, and other obstructions and to excavate the channel at critical points, with the purpose of

Flood Protection Project on Paint Rock River in Alabama, during construction.



Nashville Engineer plan for the Cumberland River Basin about 1965. Five of the dams shown were not built.

affording an adequate outlet for waters from drainage works constructed by local interests as a benefit to agriculture on some 27,000 acres of farmland.[47]

The Paint Rock River Conservancy District was organized in 1960 to comply with the requirements for local cooperation, but since Alabama law did not provide for taxation by such an agency the Engineers accepted it as the administrative organization and other financial arrangements were made. Channel rectification of Paint Rock began in 1962 and was completed in 1966; in conjunction with the locally-constructed drainage system, it opened many acres of drowned farmland to beneficial use.[48]

Another beneficial flood protection program of the Corps of Engineers was the preparation of Flood Plain Information Reports for communities which experienced or had potential for flood damages. These reports provided information for the communities about their water problems which was useful to them for city planning, zoning, industrial site location, and other purposes. The Nashville District prepared flood plain reports for Clarksville, Lebanon, and Murfreesboro, Tennessee, Williamsburg, Kentucky, as well as for other communities.

With seven local flood control projects in operation, or nearly so, and several others in planning stages, plus the preparation of flood plain studies for many communities, it was clear the Nashville District was concerned with every type of flood problem, not merely the attention-getting reservoir projects. Local protection projects have been of immense value to the areas protected since the day they were completed and rapidly paid for themselves by alleviating the heavy damages previously suffered from flooding.

CHAPTER XIII

ADVANCE PLANNING

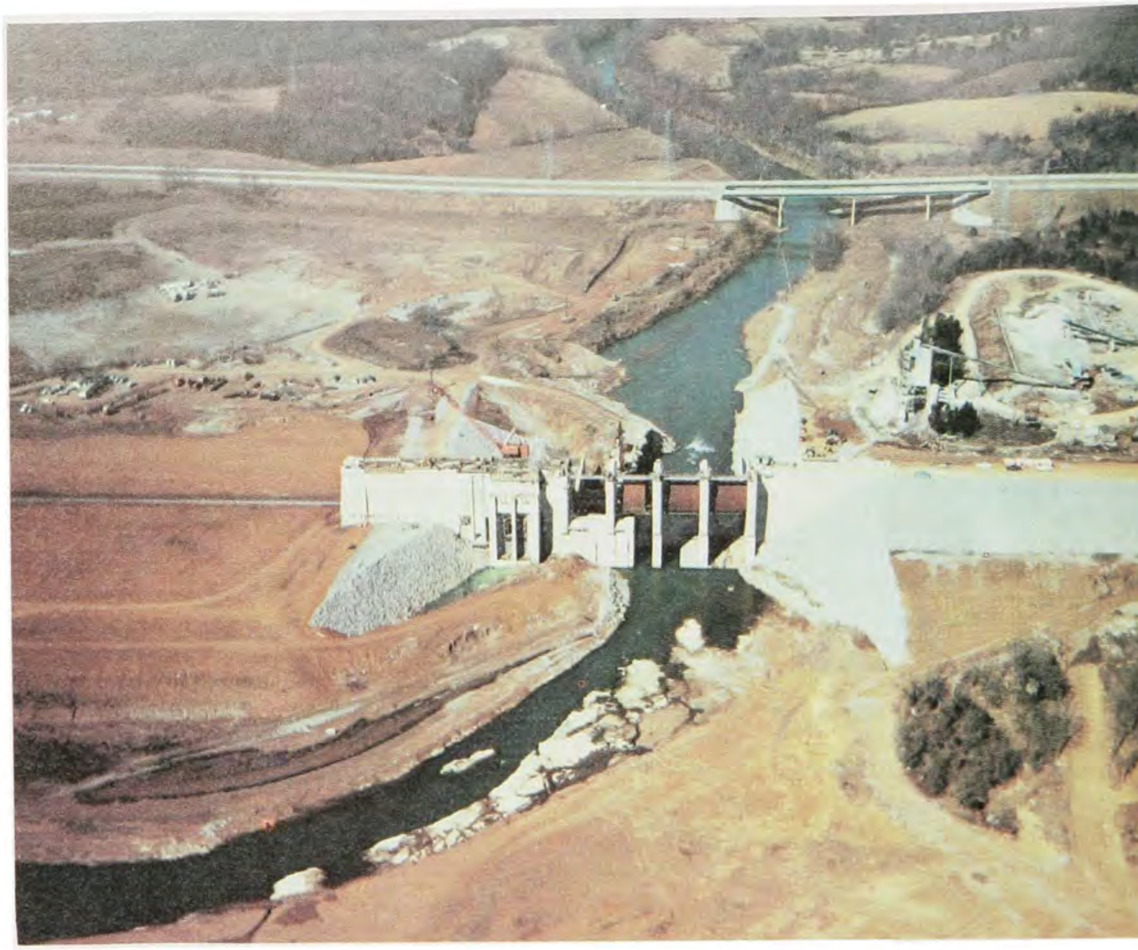
As the Army Engineers completed two centuries of service in the twin valleys in 1969, it became apparent that many visions which they had pursued for so long would be accomplished. During the 1960s, the Nashville District made much progress toward the accomplishment of its goals and began looking ahead to the end of the twentieth century when the comprehensive development envisioned in the "308 Reports" will have been largely achieved.

When Thomas Hutchins of the Royal Engineers mapped the valleys in 1769, navigation was difficult and sometimes impossible, while floods occurred an average of once a year. Since 1824, undaunted by the interruptions of wars, historic conflicts over waterways improvements, and political imbroglios, the Engineers strove steadily, at times heroically, on the twin rivers for the improvement of navigation, the control of floods, and the comprehensive development of water resources.

After the gauntlet was cast down in the "308 Reports," progress accelerated and multipurpose development became a reality. Flood devastation, once an annual ogre, was dealt a severe check; average annual damages in the Cumberland Basin were reduced to less than one million dollars. Since 1943, when Dale Hollow Dam and Reservoir began the District's major flood control operations, Engineer installations on the Cumberland have averted 76.5 million dollars in damages. A conservative estimate of the benefit-cost ratio on the Cumberland River projects is 3.6 to 1; that is, the projects during their useful life will return about $3.60 in benefits for every single dollar invested.[1]

As the Engineers completed two centuries on the Cumberland in 1969, several projects were completed, were under construction, and were authorized for future construction. The Senate Committee on Public Works resolved in 1960 that the Stewart's Ferry project on the Stone's River near Nashville be restudied, with a view to modifying project designs to incorporate advances in engineering and to add recreation as a project feature.[2] The Stewart's Ferry project, renamed J. Percy Priest Dam and Reservoir in honor of the Tennessee Congressman (1941-1956), was reevaluated and the studies revealed that recreation was an allowable project feature and that water supply availability would be of significant value to the future of the rapidly growing urban areas around the project.[3]

Technological advances made after the project was first authorized in 1938 permitted major design changes; just a few of which were the reduction of the number of tainter gates from seven to four, with a corresponding increase in size, the elimination of sluices through the face of the dam, a change to precast, prestressed concrete for the roadway bridge, and a reduction of the length of the concrete nonoverflow section.[4]The dam site, 6.8 miles above the confluence of Stone's River with the Cumberland, was down river from the fords constructed by the Union Engineers under General James St. Clair Morton in 1862 and below Sewart Air Force Base constructed by the Nashville District in 1942. It was just above Cloverbottom, where Indians and pioneers fought and where Andrew Jackson constructed flatboats for trade with New Orleans (and for



The J. Percy Priest project on Stone's River under construction on February 13, 1967.

President Lyndon B. Johnson dedicated J. Percy Priest Dam and Lake on Stone's River.

Aaron Burr) nearly two hundred years ago.

J. Percy Priest Dam, a combination earth and concrete-gravity dam stretching 2,716 feet across the river, rose majestically 130 feet above the bed of the river, a marvel to all who come upon it unexpectedly while traveling the highway which passes below (Interstate 40). It retained the water which once swooped down on Nashville in periodic flash floods and put it to beneficial use by pouring it down a penstock with a 22-foot diameter to power a 28,000 kilowatt generating unit.[5]

A primary feature of the project was the recreational opportunities it provided for the people of Nashville and surrounding area. President Lyndon B. Johnson, when he dedicated the project in 1968,

hailed the project's recreational features as a "perfect example of the New Conservation."[6]

On the main stream of the Cumberland, the District began work on the final stages of its comprehensive plans during the 1960s. Barkley Dam was placed into operation, completing the project for the section of the river below Nashville. It will be recalled that the District's 1946 plans called for construction of three dams between Nashville and Wolf Creek on the Upper Cumberland: Old Hickory, Cordell Hull, and Celina projects were designed for power production with navigational features to be added if justified by conditions when construction was initiated. Locks were added to the Old Hickory and Cordell Hull projects.

The project at Carthage (Smith County, Tennessee) was designated by Congress in 1958 as the Cordell Hull Dam and Reservoir, in honor of the Tennessee statesman who navigated that river section many times in his youth as a log raftsman. Construction began at the Cordell Hull project in 1963 and was near completion when it was dedicated in late 1973.

The Celina project, above Cordell Hull Reservoir, was located, by chance, exactly on the Tennessee-Kentucky state line, where the Cumberland begins its arc south to Nashville. The planned Celina Reservoir would follow a serpentine course through Southern Kentucky past the old steamboat landings at Burkesville and Creelsboro to the base of Wolf Creek Dam. Its construction would complete plans of the Nashville District for the navigable portion of Cumberland River.[8]

J. Percy Priest Dam and Lake.

Cellular cofferdams hold out the Cumberland while construction of the powerhouse at Cordell Hull Lock and Dam is underway on May 4, 1970.

Congressman Joe L. Evins and District Engineer James B. Newman break ground for Cordell Hull Lock, July 6, 1964.

Cordell Hull Lock and Dam

In the Upper Cumberland Basin, intensive use of Lake Cumberland for recreation and an increasing demand for hydroelectric power resulted in the authorization of an unusual reservoir project in 1960 on the Laurel River. Since the reservoir would merely retain water which would otherwise become part of the Wolf Creek pool, no flood control benefits were credited to the project, and it was authorized primarily for power production and recreation. The dam was of the rockfill variety, the only one of this type in the District, rising 282 feet from the river bed though only 1500 feet in length.[9]

Another flood control project was planned near Harlan, Kentucky, where a concrete dam would be constructed across Martins Fork, a branch of Clover Fork which is tributary to the Cumberland. The Martins Fork Reservoir project, authorized by Congress in 1965, was somewhat unusual because of its diminutive size—the reservoir covering only 675 acres.[10] The purposes of the project were to provide recreational opportunities, to improve water quality, and to provide water conservation and flood protection for the town of Harlan and downstream areas. The Federal Water Project Recreation Act of 1965 applied to this project and local interests would pay a portion of the costs and assume certain responsibilities in the operation of the reservoir. It was a small project, in comparison to the Wolf Creek and Barkley projects, but not small to the citizens of that portion of Appalachia.[11]

The Laurel River and Martins Fork projects serve as an index to growing regional demands for water. These growing demands forced constant re-evaluation of the comprehensive plans for the Cumberland Valley, for there was an increasing competition among the citizens of the valley, and of the nation, who disagreed with one another about the manner in which water resources were to be utilized. The Army Engineers attempted to reconcile these conflicts over the purposes of water resource development by providing maximum usage through multipurpose development; still, they met opposition—opposition which sometimes viewed them as exploiters, rather than conservationists of water resources.

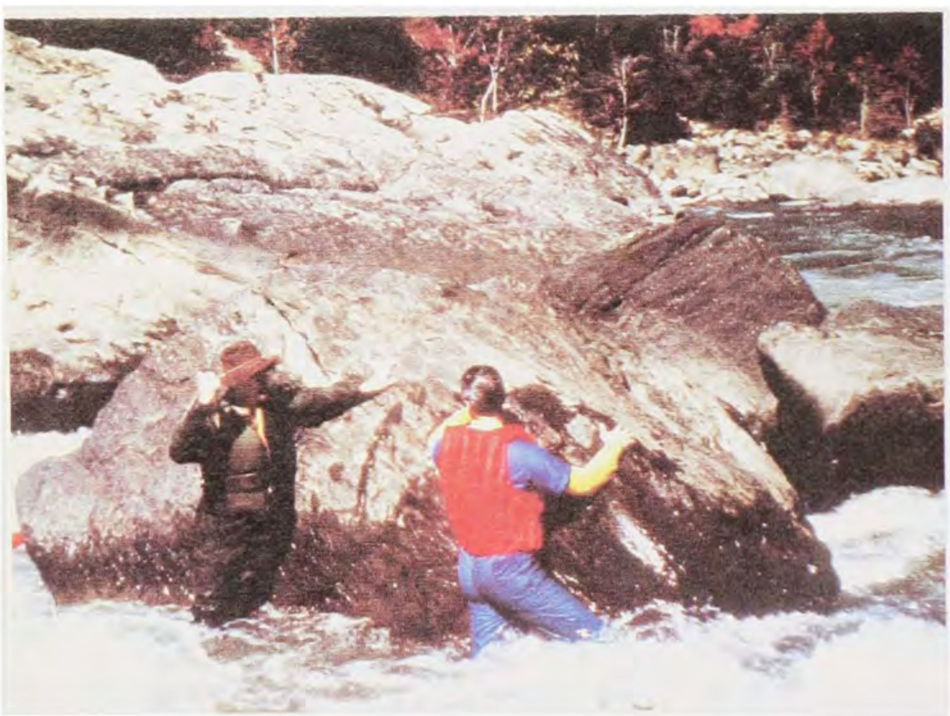
Prior to 1960, opposition to Engineer reservoir projects generally came from private power interests, coal mining interests, and those whose lands would be inundated by a reservoir. It will be recalled that opposition from those whose property would be inundated held up the Barkley project for several years. In the late 1960's and early 1970's, the District encountered different varieties of water-user conflicts and was criticized by new groups of concerned citizens, notably by those who feared adverse effects on fish and wildlife habitations and those who opposed the inundation of sites of historic interest or scenic beauty.

Two pertinent examples of this new water-user conflict were provided by the public quarrels encountered by the District at the proposed Cumberland Falls and Devils Jumps projects. Planning for these two projects was part of the "308 Report" of 1933 on the Cumberland; indeed, private power interests had contemplated power dams at the two sites as early as 1905.

The House Committee on Public Works directed the investigation of the Cumberland Falls site in 1964 for purposes of power production, recreation, and the relief of unemployment in the region. As customary, the Nashville District arranged public hearings in the area around the proposed reservoir to elicit public opinion and explain the plans for the project.[12]

The District Engineer pointed out to assemblies at Williamsburg and Corbin, Kentucky, that a dam, referred to as the Bunches Creek Dam, would be constructed about a mile above the spectacular Cumberland Falls, which because of its scenic beauty was quite a tourist attraction and the site of a state park. On Jellico Creek, which enters the Cumberland about thirteen miles above the Falls, another dam would be constructed, with pump storage as a project feature to aid in the production of power. A power house would be located about a mile below Cumberland Falls and water from behind Bunches Creek Dam would be sent down to the power house through a tunnel 300 feet underground

Engineers survey the Big South Fork of the Cumberland during the autumn of 1977. Survey party included General E. R. Heiberg, III, Ohio River Division Engineer, and Colonel Robert Tener, Nashville District Engineer.



General E. R. Heiberg, III, Ohio River Division Engineer, directs traffic past "Heiberg Rock" after a canoe spill on Big South Fork of the Cumberland in 1977. On the right is Jim Bates, Chief of Planning, Nashville District.

to take advantage of the steep gradient of the river at that point for power production.[13]

The District Engineer made it clear that the dam above and the power house below would be completely out of sight at the Falls, that the tunnel to carry the water would be so far underground that no one except the Engineers would know it was there, and that controlled releases from the reservoir above would always guarantee an adequate flow over the Falls, more than there had ever been before during the low-water season. But there was vigorous opposition to the project at the Corbin hearing from those who feared the scenic beauty of the Falls would be ruined.[14]

At Williamsburg, however, located at the upper end of the proposed reservoir, testimony, except for representatives of the coal industry, was quite favorable. The prevailing view was eloquently expressed by a physician who had served the people of Williamsburg since 1907:

> Now, I want to say that I am 100 percent for this project. Someone asked me some

> time back what was the main crop in this county, and I told them it was raising babies, and after we got them raised, we sent them out to get jobs. Now, I believe in this beauty of the Cumberland Falls; I went there in those early days when you had to push your wagon up the hill to get there, and I think lots of the beauty of it. But we can have the beauty and we can have the dam, and in my opinion, the dam will not affect the beauty of the Falls. We need something besides beauty for our children. We've got to have something more than seed ticks, and snakes, and persimmons and blackberries and chiggers down there. Now, they say, "for whom the bell tolls." I hope the bell does not toll against all the hopes and aspirations and desires of these poor mountain people, but do something for their children in the future.[15]

Despite the doctor's eloquent testimony, the District found that opinion was generally in opposition to the project; opinions expressed at the meetings seemed to favor the recreational and employment aspects of the project, but opposed the power features for fear that the beauty of the famous Falls would be marred. Since there were no flood control benefits to be derived from the project, without power production the project was not considered economically feasible and it was relegated to an inactive status.[16]

A similar conflict developed at the Devils Jumps project on Big South Fork of the Cumberland. Two dams were planned on the Big South Fork in the 1933 "308 Report," one at the Helenwood site and another at the Devils Jumps site, but engineering advances led to plans in 1961 for a single high dam at the Devils Jumps site. When the Appalachian Regional Development Act of 1965 directed preparation of comprehensive water resource plans to meet the needs of the region, the Nashville District renewed its investigation of the Devils Jumps project and held a public meeting at Whitley City, Kentucky, to solicit the people's opinions.[17]

At this meeting, advocates of the "preservationist" doctrines, representing such organizations as the Sierra Club and the Tennessee Scenic Rivers Association, expressed their opposition to the Devils Jumps project. The latter group pointed out that Big South Fork is a "free-flowing river cutting through a deep and spectacular sandstone gorge. As such, it is one of the finest deep gorge streams in the East and in its unspoiled natural setting it should be utilized for its highest and best purpose—a *unique* wilderness recreational resource."

The organization was correct; the Big South Fork is a beautiful river. But, for the most part, those at the hearing who supported the views of the Scenic Rivers Association did not live in the region, while those who lived there supported the construction of the project.[18]

Doubtless, there is a need in the United States for the preservation of both virgin wilderness and wild, scenic rivers for the benefit of the Americans who desire and need the forms of recreation which such parks provide.[19] The question really was *which* rivers would be retained in their natural state, and it was a most difficult decision that only Congress could make, for failure to develop water resources has often meant economic stagnation for the affected region. In the Rivers and Harbors Act of March 7, 1974, Congress established a national park that included most of the Big South Fork Valley and assigned the Nashville Engineer District the job of purchasing lands for the park. It appeared in 1975 that Big South Fork River would be preserved.[20]

The story of navigation on the Cumberland, at one time the only concern of the Army Engineers and the only purpose for which projects were planned, was overshadowed from 1935 to 1975 by revolutionary developments in flood control and power production, but it had not diminished. On the contrary, one of the most significant developments of the 1960's and 1970's in the United States was the renaissance of inland waterway traffic. From a low point prior to the Second World War, the growth of river commerce was sharply upward on the Cumberland and the entire network of inland waterways. As recently as 1943, waterways carried only two and a half per cent of the nation's freight while seventy-two per cent went by rail, but by 1970 the waterways share was up to sixteen per cent though rail traffic had not decreased—the growth represented not a change from rail to water but an

The steamboat *Gordon C. Greene* on September 17, 1949, lowered her stacks to slip under the bridges over the Tennessee River at Knoxville. The *Greene* was one of the last steamboat packets.

absolute increase in commercial navigation. Also significant was the fact that waterways operators, while moving sixteen per cent of the nation's freight, collected only one per cent of the nation's freight bill.[21]

The waterways transportation renaissance resulted from several different developments: the mechanization and improvement of terminal facilities for loading and unloading operations, improvements in marine engineering in the form of the twin-prop diesel towboat and the standard steel barge, and improvements in navigable waterways executed by the Engineers and other agencies of government. Navigation on the twin rivers was benefited enormously by these developments.[22]

Though old rivermen were still afflicted with bouts of nostalgia when they saw the *Delta Queen*, the *Belle of Louisville*, the *Belle Carol*, the *Julia Swain*, and a few other boats traveling the waterways, they knew the days when the gingerbread-trimmed steamboats chugged and thrashed their way up and down the Cumberland under boiling black clouds of smoke were gone forever. But the natural advantages of water transportation remained—no longer competing with rail and highway transportation, however, but specializing in bulk freight which was not in a great hurry.[23] Millions of pounds of steel reached Nashville by water each month from Pittsburgh and other steel centers; newsprint arrived from points as far away as Newfoundland via a complete water route; grain poured in from the Midwest; chemicals, petroleum, coal, lumber, sand and gravel, cement, and even bulk shipments of molasses were barged up and down the Cumberland regularly.[24]

Perhaps the esthetic qualities of the modern diesel towboat and steel barge left something to be desired, in comparison with the elaborately decorated and sumptuously furnished steamboats which once thronged the Cumberland, but their economy could not be disputed. And the old excitement of river travel still remained, even behind a tow stretching the length of four football fields ahead of the pilot house.

A typical tow on the Cumberland in 1975 might come up from Baton Rouge, or perhaps even Corpus Christi, Texas,

Modern petroleum tow on the Cumberland River near Cheatham Lock.

some fifteen hundred miles away, pushing nine million gallons of gasoline and petroleum products in a quarter-mile long string of steel barges. This petroleum tow, representative of the new prosperity of waterborne commerce, was one of the reasons there was new interest in the vision, nearly two centuries old, of a Southern Route for navigation.

One branch of the Southern Route was completed when Barkley Canal was constructed between the Cumberland and Tennessee rivers. On the other hand, the dream of linking the twin valleys with the Atlantic Ocean via the Tennessee River and the rivers of Georgia appeared to have been forgotten by the people of the twin valleys, but it received serious attention in Georgia in 1969, where some have pointed out that such a route, ice-free, would cut 2,000 miles from the distance

This nine-barge tow on the Cumberland in 1966 carried cargo that would have filled 430 railcars.

between Cairo, Illinois, and the markets of Europe. The chairman of the Augusta Ports Authority believed such a project would be constructed within fifty years, following a route up the Savannah River through Clark Hill and Hartwell reservoirs in north Georgia and to the Tennessee Valley by a canal between the Tugaloo and Hiwassee rivers. He might prove to be a prophet, for Congress approved a study of this route in 1969.[25]

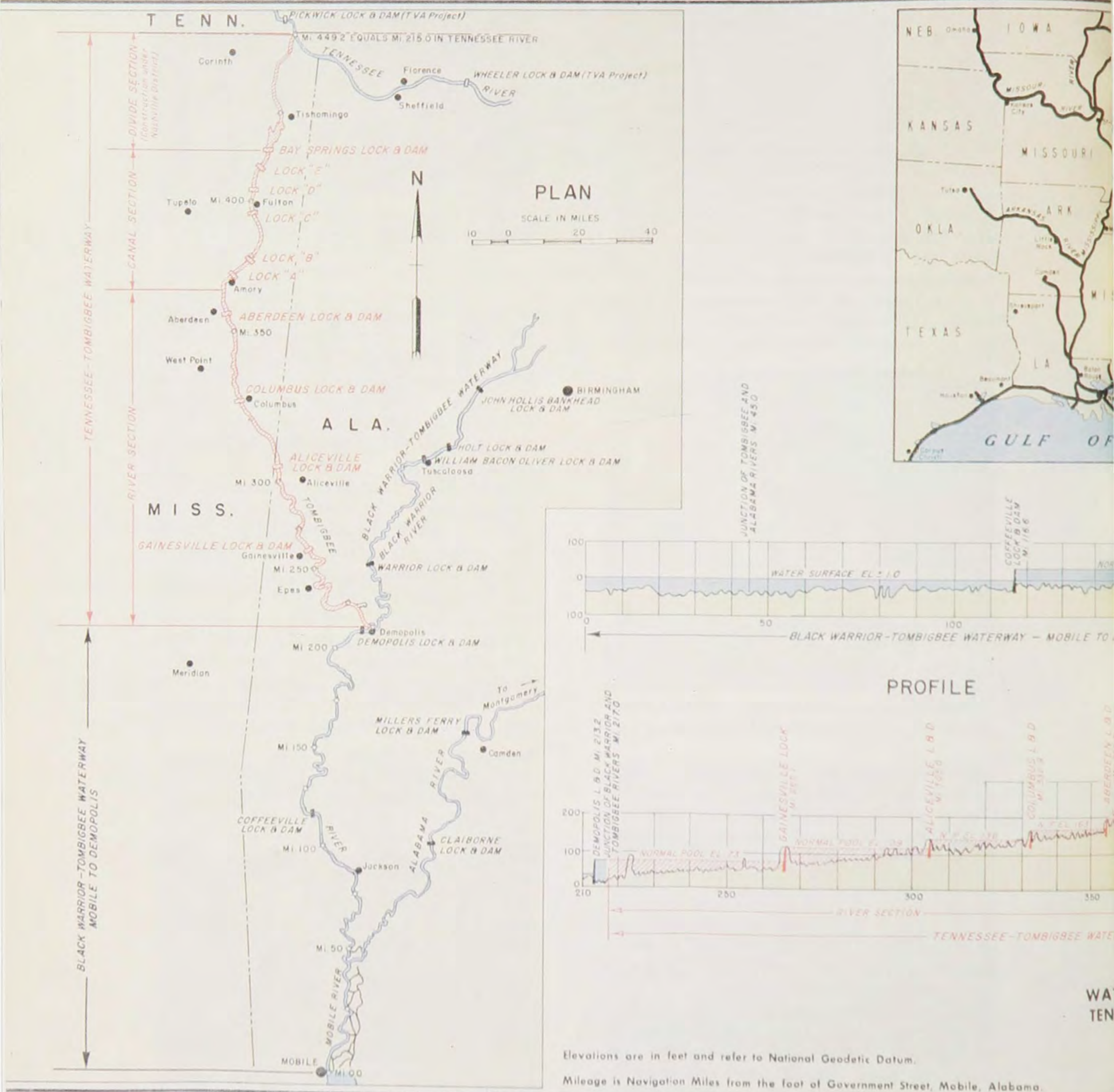
Since 1925 the Nashville District has concentrated its attention on the leg of the Southern Route which would connect the twin valleys with the Gulf of Mexico via the Tennessee-Tombigbee Waterway. A navigable inland water

In July 1946 the *Walter G. Houghland* delivered 72,617 barrels of petroleum to Nashville.

route from Mobile Bay up the Alabama and Tombigbee rivers to Columbus, Mississippi, existed, but it abruptly ended a few maddening miles from the Tennessee River. From Muscle Shoals to New Orleans via the Mississippi River route was a long 1,121 miles. By the Tennessee-Tombigbee Waterway it would only be 491 miles from Muscle Shoals to Mobile and 647 miles to New Orleans.[26]

The Nashville-Chattanooga District examined the Tennessee-Tombigbee route during the nineteenth century and studied it continuously after 1934. In that year, Congress authorized a study which resulted in the first favorable report by the Army Engineers on the project, but a portion of the benefits credited to the project in 1939 were considered intangible and the Chief of Engineers was

President Richard M. Nixon and Governor George Wallace of Alabama at groundbreaking ceremonies for construction of the Tennessee-Tombigbee Waterway.


TENN.
PICKWICK LOCK & DAM (TVA Project)
Mi 449.2 EQUALS Mi 215.0 IN TENNESSEE RIVER
TENNESSEE RIVER
Florence
WHEELER LOCK & DAM (TVA Project)
Sheffield
Corinth
Tishomingo
DIVIDE SECTION
CANAL SECTION
RIVER SECTION
TENNESSEE-TOMBIGBEE WATERWAY
BAY SPRINGS LOCK & DAM
LOCK "E"
LOCK "D"
LOCK "C"
LOCK "B"
LOCK "A"
Tupelo
Mi 400
Fulton
Amory
Aberdeen
ABERDEEN LOCK & DAM
Mi 350
West Point
COLUMBUS LOCK & DAM
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PLAN
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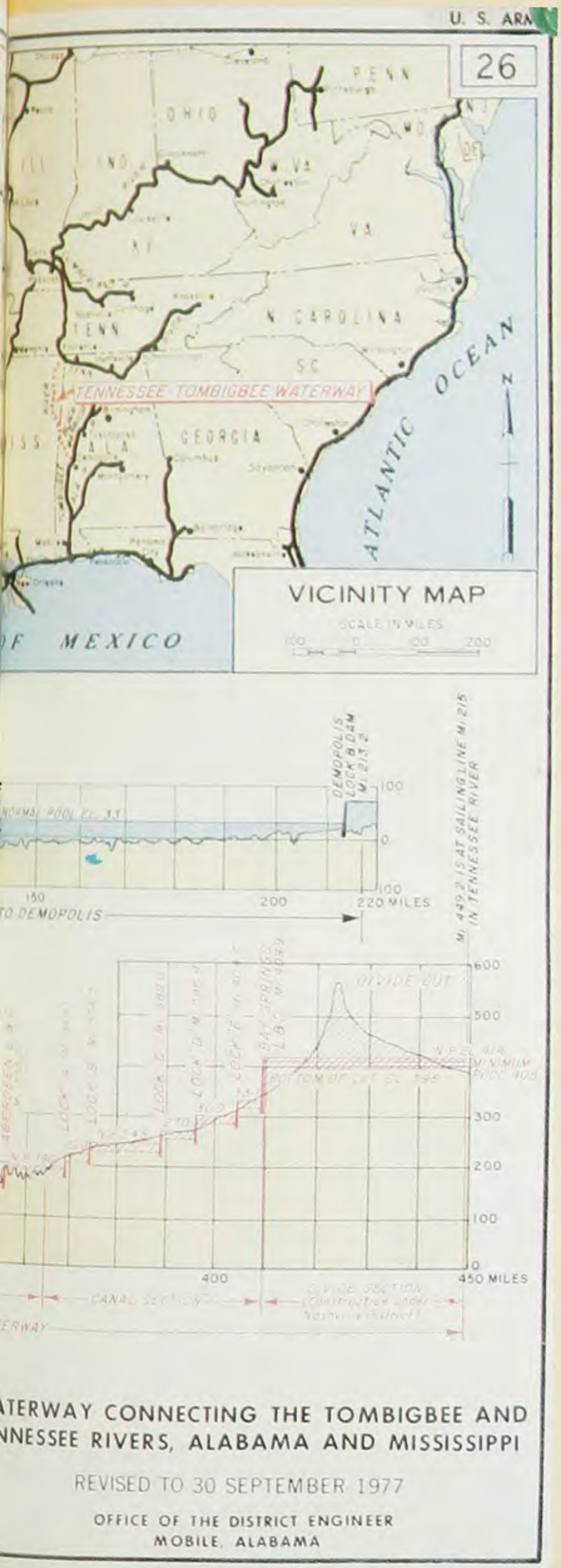
10 0 20 40
ALA.
MISS.
ALICEVILLE LOCK & DAM
Mi 300
Aliceville
TOMBIGBEE
GAINESVILLE LOCK & DAM
Gainesville
Mi 250
Epes
Demopolis
DEMOPOLIS LOCK & DAM
Mi 200
Meridian
BIRMINGHAM
BLACK WARRIOR-TOMBIGBEE WATERWAY
JOHN HOLLIS BANKHEAD LOCK & DAM
HOLT LOCK & DAM
WILLIAM BACON OLIVER LOCK & DAM
Tuscaloosa
BLACK WARRIOR RIVER
WARRIOR LOCK & DAM
To Montgomery
MILLERS FERRY LOCK & DAM
Camden
Mi 150
ALABAMA RIVER
COFFEEVILLE LOCK & DAM
CLAIBORNE LOCK & DAM
Mi 100
Jackson
Mi 50
MOBILE RIVER
MOBILE
Mi 0.0
BLACK WARRIOR-TOMBIGBEE WATERWAY MOBILE TO DEMOPOLIS
NEB
IOWA
KANSAS
MISSOURI
OKLA
ARK
TEXAS
LA
GULF OF
JUNCTION OF TOMBIGBEE AND ALABAMA RIVERS Mi 45.0
COFFEEVILLE LOCK & DAM Mi 116.6
WATER SURFACE EL ±1.0
BLACK WARRIOR-TOMBIGBEE WATERWAY — MOBILE TO
PROFILE
DEMOPOLIS L & D Mi 213.2
JUNCTION OF BLACK WARRIOR AND TOMBIGBEE RIVERS Mi 217.0
GAINESVILLE LOCK
ALICEVILLE L & D
COLUMBUS L & D
ABERDEEN L & D
NORMAL POOL EL 73
RIVER SECTION
TENNESSEE-TOMBIGBEE WATE
WA
TEN
Elevations are in feet and refer to National Geodetic Datum.
Mileage is Navigation Miles from the foot of Government Street, Mobile, Alabama.



cautious in his appraisal of the project.[27] The Chief admitted that such intangible benefits as those credited to national defense, enhancement of land values, and increased use of recreational facilities would result, but the favorable benefit-cost ratio (1.16 to 1) was dependent upon them in addition to the direct savings in transportation costs. He cryptically concluded the intangible benefits "are difficult to evaluate and appear to me to be questions falling within the realm of statesmanship to which the Congress can best assign the proper values."[28]

No action was taken at that time, but the boom of traffic on the waterways during World War II led to a reassessment of the project in 1945. All intangible benefits were eliminated in the 1945 study, and the value of the project was calculated strictly on the basis of savings to waterways transportation. Chief of Engineers Eugene Reybold strongly approved of the project, declaring:

> Commercial benefits from the project recommended will more than offset its economic costs. In addition, there will be important intangible benefits from the construction of the proposed waterway, including the stimulation of new production now unwarranted because of high transportation costs, the provision in time of war of a shortened water route between Gulf and northern inland points for the haul of strategic materials and military and naval craft, and the improvement of recreational facilities and land values in the tributary area.[29]

Congress authorized the Tennessee-Tombigbee Waterway in the Rivers and Harbors Act of 1946, but although the Engineers estimated savings in 1951 of a million dollars per year the project was again deferred for study. In the meantime, public support for the project grew. The Tennessee-Tombigbee Waterway Development Authority was created in 1958 to promote the project. It was composed of the Governors and appointed members from five states: Alabama, Florida, Kentucky, Mississippi, and Tennessee, and it became the foremost proponent of the project.[30]

Study was renewed in 1957, with the Mobile District assigned the planning for the canalized section of the Tombigbee

Construction of the Tennessee-Tombigbee Waterway: dredging Yellow Creek embayment at Highway 25 in 1976.

River and the Nashville District the planning for the canal and divide cut sections between the Tombigbee River and Pickwick Reservoir on the Tennessee. Traffic on the inland waterways continued to rise sharply, and with each increase the amount of potential benefits credited to the project rose. In 1970 the benefit-cost ratio had risen to 1.6 to 1; that is, for every dollar invested a return of $1.60 could be expected during the life of the project. This was in addition to "intangible" benefits, and this favorable situation finally brought action thirty years after the first favorable report on the waterway when President Richard Nixon included funds to initiate construction of the project in the budget.[31]

Construction of the waterway was underway in 1975, and the visions of Zachariah Cox, the founder of Smithland, and the others who have supported the Southern Route during the past two centuries will be fulfilled. The project providing a nine-foot channel for modern barge traffic, will undoubtedly stimulate an enormous growth of commerce on the twin rivers and a new prosperity for the Central South.

It should be clear, therefore, that, though power production and flood control have received more emphasis in the recent history of the Nashville District, navigation has not been forgotten or neglected. Recently, however, the average citizen of the Cumberland River Basin, as in the nation, displayed more interest in the recreational and water quality benefits of Engineer projects.

One of the characteristics of American democracy, at least in the modern era of instant communications, was that when

problems arose they received extensive, almost daily, publicity for a time and the nation was gripped by a near obsession with the subject, then public interest seemed to flag and the subject nearly disappeared from the news media. The Engineers hoped, however, that this would not be true of the problem of water quality, a problem which concerned the Engineers for many years, but which found little public support until the advent of the environmental issue.

What must have been the first report on the water quality of the Cumberland River was prepared by Principal Engineer John S. Walker of the Nashville District in 1904 for presentation to the Engineering Association of the South. He reported that during construction of locks above Nashville he found no evidence of pollution, but at the two lock sites below the city vile odors emanated from the lock pits, workers became nauseated, and the water was unfit for human consumption.[32]

From 1938 to 1943, the District participated in the earliest pollution survey of a major river basin, which encompassed the Ohio River and all its tributaries. The Chief of Engineers hailed the report as the "most complete and comprehensive examination ever made into the sanitary conditions of a major river and its tributaries." In collaboration with the Public Health Service and the Tennessee State Health Service, the Nashville District thoroughly studied the water quality of the Cumberland and reached the same conclusion John S. Walker had forty years before. The only serious pollution problem on the Cumberland River was near Nashville.[33]

The Refuse Act of 1899 was, until 1970, interpreted to mean only that the discharge of solid waste or debris which might constitute a hazard to navigation was illegal. In 1970, however, the Refuse Act was made applicable to all firms or persons proposing to discharge, or continuing to discharge, wastes into navigable waterways and their tributaries. Legislation—the National Environmental Policy Act of 1969 and the Water Quality Improvement Act of 1970—was also enacted to provide for improved water quality.[34] The Nashville District established a Water Quality Unit, purchased laboratory equipment, and staffed it with qualified personnel to implement a program of data collection and analysis to aid in assuring better water quality in the Cumberland Basin.

Railroad relocation in divide section of the Tennessee-Tombigbee Waterway.

The Engineers had the capability of abating serious threats of pollution to public health during the low-water season by controlled releases from upstream reservoirs. This was a benefit of flood control projects which seldom received the attention it deserved. For example, the autumn of 1963 was a period of prolonged drouth in the Cumberland Valley, but the flood control projects above Nashville maintained an average water flow past Nashville of 4200 cfs; that is, about ten times what it would have been under natural conditions.[35]

The Engineers welcomed the nationwide focus on the problems of environmental quality and hoped it would endure, for it assured support for a water quality program that was sorely needed. Though the Cumberland has been well known among rivermen as a clean river—boats which travelled the inland waterways were scrubbed down while they were on the Cumberland—the in-

creasing industrialization and expanding population of the Cumberland Valley could create serious water pollution problems in the future.[36]

Most citizens never thought of the Corps of Engineers when they casually flipped a light switch, twisted the tap for a glass of water, or read in the news of heavy rains up the valley. Indeed, they probably never thought of the Corps of Engineers at all until they went fishing, or swimming, or boating at a reservoir project; then the value of the Engineers' development of the basin's water resources forcefully presented itself. Population growth, plus an increase in leisure time available to the average citizen, meant a spectacular growth in the recreation use of the reservoirs in the Nashville District from 1950 to 1975. Two or three of the District's projects consistently ranked among the top ten reservoirs in the nation in numbers of visitations, the number of people taking advantage of recreational opportunities. Lake Cumberland and Old Hickory Lake were the two most heavily used projects in the District; during 1969 Lake Cumberland ranked fourth in the nation and Old Hickory fifth. They were joined by the recently completed J. Percy Priest project, which ranked ninth in 1969.[37]

Fishing is the most popular water sport at Engineer projects at present, and the Engineers did their utmost to make the fishing enthusiast's visits enjoyable. This involved the Engineers in cooperative endeavors with the state game and fish commissions and other agencies in efforts to provide the finest fishing in the nation. Surprisingly, records revealed the District was concerned with the

People throw everything in our rivers including the kitchen sink.

effect of its projects on fishing long before it constructed a single reservoir project. Fish-passages across the dams of the old canalization project were built before the turn of the century, and in 1913 a District Engineer ordered that dynamite charges not be detonated by construction crews until the water had been disturbed to frighten fish away; though, it is rather difficult to imagine anyone running up and down the river bank beating on the water with a stick anywhere near an unexploded dynamite charge.[38]

Increasingly heavy use of reservoirs for recreation produced inevitable conflicts between various groups of sportsmen. Fishermen objected to "those crazy speed boaters," and practically everyone objected to water-skiers, unless the skier happened to be a shapely lass in a daring bikini. Some came to the water for a refreshing respite from their daily tensions and wanted solitude; others enjoyed a boisterous outing with their friends. And thus it went; reservoir management could be a complicated, thankless business.

Numerous tragedies at reservoir projects were also a source of serious concern to the Nashville District. Since Dale Hollow was impounded in 1943, there were 373 drownings, 59 of them children, at District reservoir projects. Many of these unfortunate accidents could have been averted had proper safety precautions been taken, and District Engineer John C. Bell launched an intensive campaign in 1970 to reduce the number of accidents on and in the water by making recreationalists more safety conscious.[39]

Perhaps the safety program was one area where the Engineers would have the complete, wholehearted support of the public. If so, it would be unique, for it was the lot of the Engineers as public servants to continually be in the middle of controversy. The program of the Engineers was criticized by those whose personal philosophy or special interest placed them in opposition to regulation or participation by the Federal government in water resource development; on the other hand, those who wished a highly centralized Federal control over

Enjoying recreation at Engineer lakes does not require expensive equipment, as this fisherman at Nice Mill, J. Percy Priest Project, will testify.

water resource development were also critical.

One oft-repeated criticism was that the program of the Engineers was enmeshed in politics, and the Engineers have not denied it; indeed, they take a certain pride in it. Politics, ideally, represented the expression of the will of the sovereign of the United States—its citizens, and General Lytle Brown succinctly summarized the Engineers' position on the subject of politics in 1935:

> It may be said with equal truth that politics may further the adoption of a project, and may prevent it. Furthermore, as may be claimed without disturbing the equanimity of a citizen or his faith in his government, politics is involved in everything that affects the welfare of the people of the Republic. Otherwise there would be no democratic principle in the government.[40]

The history of the Nashville District revealed the only effect of politics on the comprehensive development of the Cumberland was to influence the timing of the program by speeding or delaying appropriations. Since before the publication of the "308 Reports," when Congress occasionally directed construction

Family recreation below Wolf Creek Dam.

of a project not approved by the Engineers, no project has been constructed without complete engineering and economic studies which demonstrated conclusively that benefits deriving from a project would exceed costs by a substantial margin. Even then, the project was not constructed if there were an intense and vocal opposition by local citizens.

Another common charge has been that the Engineers' program has been piecemeal, uncoordinated, and wasteful. There may have been some truth to this allegation prior to 1930, but not much since the beginning of comprehensive planning and development. For example, the Nashville District's plans for the Laurel River Reservoir in 1960 were critically reviewed by a total of eight other agencies: Bureau of the Budget, Commonwealth of Kentucky, Department of the Interior, Department of Agriculture, Department of Commerce, Public Health Service, Federal Power Commission, and the Tennessee Valley Authority. These were in addition to the customary review by the Ohio River Division, the Board of Engineers for Rivers and Harbors, and the Chief of Engineers.[41]

As to the charge of waste, project studies by the Engineers have applied rules of interest, amortization, depreciation, and operating and maintenance costs used by any private concern in a similar study, and only a fraction of the projects which Congress proposes are ever constructed. General Douglas MacArthur once observed that the reputation of the Corps of Engineers actually rests on the projects which it does not build.[42]

Complete, accurate, comprehensive planning was imperative by 1975, and the organization and operation of the Nashville District had become increasingly complex as a result. Work of the District involved all major branches of engineering, plus specialized subdivisions, and the District either employed scientists in geology, biology, economics, hydrology, soil mechanics, statistical analysis, and related fields, or had them at its call from the Ohio River Division and the Office of the Chief of Engineers.

It has been the object of the Corps of Engineers to provide the nation with the finest engineering and construction capability possible—an agency ready to meet the needs of defense construction or water resource development as circumstances may require. The prosperity and welfare of the people of the twin valleys and the nation, in combination with constructive conservation of natural resources, were the ultimate goals of the Nashville District, and these goals placed it in the front line of the nation's defense, because success in warfare in the twentieth century depended upon the welfare of a nation's people.

The success of the Nashville District toward achieving its goals was amply demonstrated by the historic contributions of its projects to the defense and prosperity of the twin valleys. The Cumberland and Tennessee Valleys were in the throes of a great economic revolution in 1975, as was much of the remainder of the South. The South had only nine per cent of the nation's industries at the beginning of the twentieth century, but by 1975 it had about twenty-five per cent. The late, and occasionally lamented, agrarian South had largely disappeared, replaced with a more balanced economic structure. Without doubt, much of this revolution could be attributed to comprehensive development of water resources, which provided flood control, hydroelectric power, abundant water supply, and low-cost transportation.[43]

In 1969, two centuries after a British Army Engineer mapped the Cumberland, Army Engineer projects on the river averted $20,484,000 in flood damages, produced 1,689,686,157 kilowatt hours of

Nashville District staff in 1977
from left to right, front row:
Charles Hooper, Hobart Parish, Billy Grantham, Jack Bond, LTC Stephen Matteson, Col Robert Tener, Maj Ralph Danielson, Sue Thibault, Dan Hall and Leon Johnson.
Second Row:
Maurice "Bo" Lewis, John Lambrecht, Howard Boatman, Hugh Cates, Melvin Evans, Bill Eastland, Richard Nimmo, Oscar Krosnes, E. C. Moore, Fred Shelton.

electric power, provided recreation for 23 million people, aided the movement of five million tons of raw materials and finished products, and provided other related benefits.[44] Effects of these contributions on the life of the average citizen of the Cumberland Valley are truly incalculable, unless one speculated on what life might have been like in the valley had it been determined during the early history of the nation that the Federal government had no interest in navigation and subsequently in water resource development. Despite the achievements of the American free enterprise system and of state governments, such speculation leads to the conclusion that the contributions of the Engineers have been staggering in scope, with substantial benefits to all citizens, whether they lived and worked on the banks of the Cumberland or some distance away.

The history of the Nashville District revealed that fifty years may elapse between the conception and the completion of the comprehensive development of a river basin, and, since the projects were and are designed for many decades of service, long range planning and forecasting of economic, recreational, transportation, and other trends are vital to the success of the Engineers' program. It was expected that full development of the Cumberland River Basin, insofar as possible and desirable, and the construction of major segments of the integrated waterway system known historically as the Southern Route will have been completed by the end of the century. In 1975 the Nashville Engineer District was engaged in advance planning for the twenty-first century.

Blacksmiths at work inside the District's machineshop boat on the Tennessee River in 1915.

EPILOGUE

"THE CORPS CARES"

New offices, new faces, new missions; certainly the 1970's were years of transition for the Nashville Engineer District. Change, symbolized by the relocation of the District office in 1974 to a new Federal Office Building in Nashville, seemed the order of the day.

The change in District personnel was just as striking as the new District office. Men who had begun their Corps careers during the Depression years, at the outset of the flood control and multipurpose development missions, had reached retirement age by 1978. During their forty years of service, the "Old Guard" had achieved an enviable reputation that their young successors were eager to equal or surpass; but through new channels and with fresh ideas. Navigation, flood control, hydroelectric power, and water resource development were not dead issues and received the close attention they merited; nevertheless, in the Nashville District in 1978 one heard frequent discussion of subjects such as recreation-resource management, environmental engineering and preservation, equal employment opportunity, and disaster assistance. The new emphasis seemed based on consideration of human values, in addition to economic and engineering concerns.

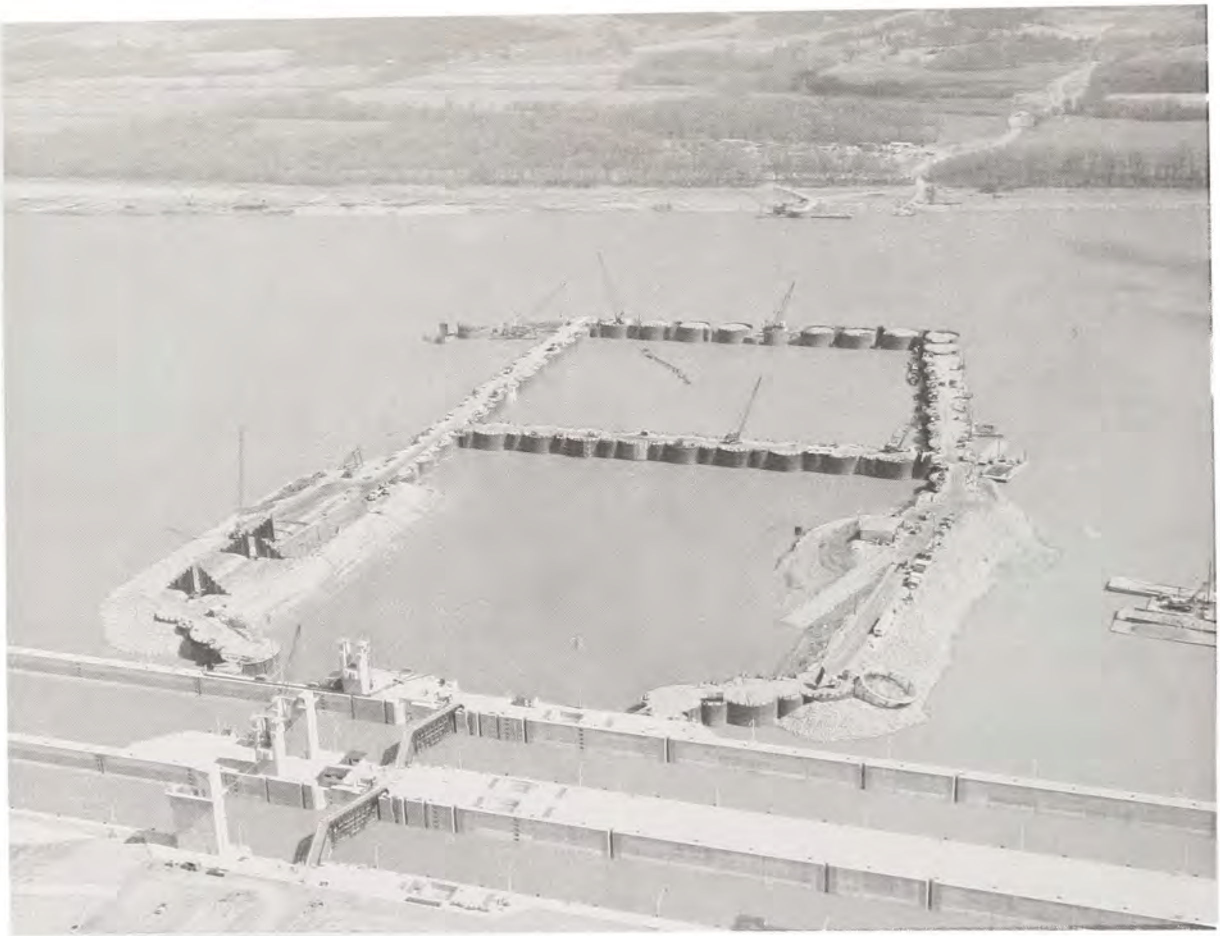
Intense recruiting of minority and women employees, not merely at the lower grades, resulted in dramatic changes in District staffing. During the decade preceding 1978, the Nashville District employed its first female reservoir ranger, geologist, and supervisor, its first minority engineer and attorney.

During the late nineteenth century, the Corps of Engineers employed probably more blacks in the South than any other agency of the federal government. Pictures of the Muscle Shoals Canal project, for instance, show the District's construction force was almost entirely black; and the District employed thousands of blacks well into the twentieth century, until hired labor construction was replaced with the contract system. Contractors of the Nashville District continued to rely heavily on black labor, but few blacks held the higher paying jobs.

Active recruiting of minorities for positions with upward mobility became Corps policy by 1968. An Equal Employment Opportunity Office with a full time staff was established in the District, and in the five years ending with 1978 minority employment more than tripled, with some holding or training for high grade positions. Although it was the southernmost District in the Ohio River Division, the Nashville District led the Division in both rate of change and total employment of minority personnel.

Opportunities for women in the District were also enhanced. Since its founding, the Nashville District had employed women, and some, such as Alice Carter who joined the District in 1891, had dominated daily work at the District office. Still, women generally held secretarial and clerical positions and rarely were given opportunity for service in the field. About the only exceptions were wives of lockmasters, who occasionally operated the locks while their husbands were incapacitated; lockmasters and their families lived alongside the old locks on the Cumberland and Tennessee.

The new leadership of the Nashville District was involved from 1972 to 1978 in three major construction projects: Martin's Fork Dam, Smithland Locks and



Smithland Locks and Dam on the Ohio River on March 10, 1976. Nashville District directed construction of this project until 1977.

Dam, and the Tennessee-Tombigbee Waterway. The District completed design and real estate acquisition for the Martin's Fork project, a small dam on one of the three streams which merge at Harlan, Kentucky, to form the Cumberland River, and, to equalize workloads, turned it over to the Pittsburgh Engineer District for construction. The construction task returned to Nashville in 1978, when construction assignments within the Ohio River Division were realigned. Smithland Locks and Dam, a massive navigation project, the largest twin-lock facility in the world, astride the Ohio near the mouth of the Cumberland, was a Louisville Engineer District project, for which the Nashville District directed construction until 1977.

Work on the 232-mile Tennessee-Tombigbee Waterway, connecting the Tennessee River on Pickwick Lake to the Black Warrior-Tombigbee River system at the southern terminus near Demopolis, Alabama, began on December 12, 1972, in the Mobile District and continued at an accelerated pace thanks to an excellent funding program by Congress. The Mobile Engineer District was responsible for the 168-mile river section with four locks and dams between Demopolis and Amory, Mississippi, and a 45-mile canal section with five locks from Amory to Bay Springs. The Nashville District had design and construction responsibility for the 40-mile divide section from Bay Springs Lock and Dam north to the Tennessee River. Bay Springs Lock, with standard 110 by 600 feet chamber dimensions, was to have an 84-foot lift, third highest in the eastern United States.

The Waterway presented great engineering and environmental challenges. In the Nashville District section alone, it required relocating *two* major railroad tracks, four highways, telephone and power lines, a pipeline, and several cemeteries. The divide cut section consisted of a six-mile dredged channel, a 27-mile cut through the divide, and Bay Springs Lock and Dam with a seven-mile long reservoir.

The first work on the Nashville District portion, dredging the Yellow Creek embayment in Pickwick Lake, began in May 1974 and was completed in June 1976. The contractor dredged two million cubic yards of overburden and 450,000 cubic yards of rock. The divide cut would require moving about 146 million cubic yards of material, about 70% of the excavation required for the Panama Canal.

The Tennessee-Tombigbee Waterway Authority maintained that the Waterway would help solve such national problems as inflation, the energy shortage, unemployment, and population distribution. The Authority estimated that the project would generate $2.8 billion worth of industry; and by 1978 over $1 billion worth of new industry had been announced. Because it shortened the distance from Tennessee River ports to the Gulf of Mexico by as much as 823 miles, the Engineers estimated the Waterway would handle 28 million tons of commerce annually at completion, eventually increasing to 50 million tons a year, with resulting savings in transportation costs and energy. A 1970 Rand Corporation

Yellow Creek Port, northern terminus of the Tennessee-Tombigbee Waterway. March 18, 1976.

Opponents of the Tennessee-Tombigbee Waterway expressed their opinion at hearings in Columbus, Mississippi, in March 1977.

study found that a dollar would move a ton of freight 330 miles by water, 180 miles by rail, 15 miles by truck, and 5 miles by air.

Opponents to the project were not swayed by such arguments, however, and they continued to oppose the Waterway. A federal district court ruled against environmentalists groups in a suit they brought against the project in 1972, but they joined with the Louisville and Nashville Railroad in late 1976 to file a new suit asking that the project be stopped. Court action was scheduled for 1978.

As part of a Presidential review of federal water projects, on March 29, 1977, the Nashville and Mobile Engineer Districts held a public hearing on the project, attended by more than 6,000 people, at Columbus, Mississippi. Records of that hearing showed that 9,400 people expressed support and fewer than 200 voiced opposition to the Waterway in oral statements, letters, and petitions.

Governor George Wallace tells Colonel Henry Hatch and Colonel Charles Blalock why he supports the Tennessee-Tombigbee Waterway.

Governor George Wallace, chairman of the Tennessee-Tombigbee Waterway Authority, urged more rapid funding for the project. The Authority estimated that if the project could be finished by 1984, more than $200 million in construction costs and transportation benefits might be saved. "How many projects," Governor Wallace asked, "have you heard of that can be finished ahead of schedule and cost less than anticipated?"

Waterway proponents argued that the project had social and human values that could not be ignored. Employment by project contractors passed the 2,000 mark in 1977, providing better paying jobs in one of the poorer sections of the nation. And the Engineers were implementing many Affirmative Action programs on the project: local labor preference, minority business utilization, and minority and female employment.

Public affairs officers for the Engineers during the 1970's popularized a slogan—"The Corps Cares"—highlighting a concern for human and social values. Commitment to the idea represented by that slogan was probably best demonstrated by increasing Corps involvement in disaster assistance missions.

Federal disaster relief activities can be traced back to 1794, but the mission belonged chiefly to the Army Quartermaster Corps, which distributed surplus Army rations, clothing, and tents to disaster victims. Engineer involvement in disaster assistance was first limited to individual, humanitarian efforts, but by 1882 the Engineer civil works districts had a sizeable flotilla of workboats strategically located along the American inland river system and coastal ports, and Congress began to call upon the Engineers to distribute relief supplies aboard the work fleet. Because the decentralized Corps organization made available competent engineers near the site of every major disaster, Congress also began to rely on the Corps for accurate reporting of disaster situations,

Samuel A. Weakley took these pictures of 1916 flood damages along the French Broad River near Asheville, where the Nashville District performed its first major disaster assistance mission. Note the street cars washed out of Asheville by the flood.

especially floods, though the Engineers were also called upon during windstorms, fires, and earthquakes.

The first Nashville District disaster assistance mission of record occurred in 1897, when District Engineer John Biddle exercised his authority to use floating plant in emergencies where life and property were threatened. A record flood on the Mississippi and Obion and Forked Deer rivers in March 1897 inundated large sections of West Tennessee, and the mayor of Dyersburg asked that the Engineer barges and quarterboats moored at Dyersburg help rescue and shelter people marooned by the flood. (The Nashville District was responsible for the Obion and Forked Deer rivers until 1923, when they were transferred to the Memphis District.) Captain Biddle sent his assistant Benjamin F. Cheatham, son of the Confederate General, to Dyersburg to direct the operation, and Cheatham rescued about a hundred refugees, sheltering and caring for them aboard the Corps quarterboats. Cheatham left the District in 1898 to join the Army in Cuba; in 1926, he became Commanding General of the Quartermaster Corps.

Throughout the twentieth century, the Engineers have had standing authority to conduct rescue operations and to preserve and repair navigable channels and flood protection structures; that is, to engage in "flood fights." Except in special cases, such as the 1906 San Francisco earthquake, however, disaster recovery work—the supply of food, clothing, and shelter, and aid with debris clearance and reconstruction-rehabilitation—was the job of the Quartermaster Corps, the Red Cross, and local and state governments. In fact, Engineer officers often questioned the wisdom of direct disaster relief.

During major floods, when workers for sandbagging and other emergency flood fight services were badly needed, the Engineers often found they could not secure labor when the Quartermaster Corps was issuing free rations, shelter, and medical aid. The Engineers believed that disaster victims who were physically able should be required to work for their rations and subsistence; and after 1912, when many levees along the Mississippi were lost because laborers enjoying free rations refused to work, the Engineers took their complaint to Congress. They argued that work relief, not government handouts, was the proper method of assisting the needy.

In 1916, Congress gave the Engineers a chance to test their theories, giving the Corps charge of ration distribution during a spring flood on the Mississippi. The Engineers took care of those unable to work, but all others were required to join the flood fight on the levees to obtain assistance: no work, no rations. The decline in the demand for rations was amazing.

After a hurricane struck Mobile in July 1916 and sent heavy rains inland, causing flooding that destroyed crops, roads, and bridges, Congress declared practically the entire South a major disaster area and ordered the Engineers to furnish assistance by employing the destitute upon projects to restore navigable channels and public roads. Nashville District damage surveys showed that the hardest-hit section of the District was Buncombe, Henderson, and Transylvania Counties, North Carolina, in the French Broad River basin near Asheville. As much as 14.7 inches of rain had fallen there in forty-eight hours, destroying roads and bridges to the extent that the mountaineers could not obtain food and supplies, nor market the part of their crops that remained.

Nashville District Engineer Lytle Brown sent Captain Jarvis J. Bain and engineers Walter S. Winn and Harry C. Smith to Asheville. Those engineers decided to employ the destitute at $1 per day to restore the washed out roads and bridges, securing the cooperation of local governments for planning and conducting the work. Local governments furnished the tools, dynamite, and materials, and the Engineers paid destitute men for their labor.

By the end of 1916, a total of 89.5 miles of road and a few bridges had been repaired and rebuilt in the North Carolina disaster area, making them again passable for wagons. The work had been done with such economy that the District Engineer returned $15,570 of the $30,000

The Nashville District's diesel towboat *John C. Irwin*, October 25, 1935.

allotment to the Treasury. Similar work was performed in the Engineer Districts at Charleston, South Carolina, Wheeling, West Virginia, and Mobile and Montgomery, Alabama. It therefore appears that the work relief concept originated with the Corps of Engineers, not with the alphabet agencies of the Depression years.

Though the Engineers were called upon during the Depression years to furnish work relief in cooperation with agencies such as the Public Works Administration, they were unable to carry on with the concept of work relief as a method of disaster assistance. In 1917, overall supervision of Army participation in disaster missions was given to Army Corps Area commanding generals, who as a rule assigned disaster recovery work to the Quartermasters. Except in rare instances, Engineer disaster assistance work was limited from 1917 to 1950 to rescue and flood fight operations.

Federal disaster assistance has historically been offered only in situations where local and state resources were

District towboat *Warioto* in Lock 1, Cumberland River, on April 29, 1916..

Chattanooga airport, 1973 flood.

inadequate. The Cumberland and Tennessee River basins, which comprise the Nashville Engineer District, had few catastrophes that forced a call for outside assistance during the decades between 1920 and 1970. Disaster situations were normally handled by the National Guard, the Red Cross, charitable organizations, with occasional assistance from agencies such as the Civilian Conservation Corps.

The Corps of Engineers was active during floods, of course, basing its response upon the seriousness of the situation. During the January 1937 flood, which set new records on the lower Ohio, lower Cumberland, and other rivers, District Engineer Bernard Smith sent the entire District fleet down the Cumberland for rescue and relief work in the vicinity of Clarksville, Eddyville, Gilbertsville, Paducah, and Golconda. The fleet included the towboats *Warioto, Colbert, Tennessee,* and *J. C. Irwin* and all the launches, barges, quarterboats, derrickboats, and skiffs the District could muster. It was hazardous work: because bridges were too low, the fleet steamed over farmland and bridge approaches, risking entanglement in telephone and power lines. The District lost six skiffs and outboard motors during the rescue effort.

During 1951 and 1957, the District directed flood fights at Barboursville and Pineville on the upper Cumberland River, where the District was building local protection projects. And in 1957, when President Dwight D. Eisenhower declared Eastern Kentucky a flood disaster

area, the District joined with the Louisville Engineer District in rebuilding wrecked foot and vehicle bridges, which included many swinging bridges.

Congress aided disaster-stricken communities between 1945 and 1950 by giving them war surplus materials, and when those supplies were depleted Congress enacted the Disaster Act of 1950. The Act allowed the President to send assistance when requested by the Governors of devastated states and established a coordinating agency to supervise federal disaster assistance activities. After a series of reorganizations, that coordinating agency became known as the Federal Disaster Assistance Administration (FDAA).

The FDAA commonly called upon the engineering-construction expertise of the Engineers for damage surveys, and it sometimes assigned the Corps other missions such as debris clearance and construction of temporary housing facilities for refugees. The Nashville Engineer District had few catastrophes that qualified as "major disasters" prior to 1973. In fact, District personnel gained much of their disaster emergency experience by helping out at disasters in other Districts. They traveled to Boston in 1955 to help with recovery from Tropical Storm DIANE, to Alaska in 1964 to help repair damages done by the "Good Friday Earthquake," to Minnesota and North Dakota in 1969 to participate in Operation Foresight (flood protective measures along the Chippewa and Red River of the North), and to the East Coast in 1972 after Tropical Storm AGNES, which resulted in the most costly recovery effort in American history. But after 1972, "major disasters," eligible for federal assistance, occurred in the Nashville District nearly every year.

As a result of severe storms and flooding in late May 1973 in the Upper Tennessee River Basin, the Office of Emergency Preparedness, forerunner of FDAA, opened field offices at Oak Ridge, Chattanooga, and Huntsville, assigning the performance of damage surveys to the Nashville District. Certain types of disaster damages are eligible for repair and reconstruction with Federal funding, and the Engineers inspect those damages, estimate the costs of repair or restoration, and furnish technical assistance to local communities contracting for the repairs. Preparing damage survey reports keeps the Engineer survey teams constantly on the road, and it is customary to establish a centrally located disaster field office as base for those teams. The Nashville District's damage survey teams after the May 1973 flood covered most of East Tennessee, and other teams went to Birmingham, Alabama, to help the Mobile District with a recovery effort following a tornado in that vicinity. Later that summer, District personnel served at St. Louis and Vicksburg during a major flood on the Mississippi.

Swarms of tornadoes crossed Tennessee and nearby states during early April 1974, killing forty-eight people in Tennessee and more to the north where Xenia, Ohio, and Brandenburg, Kentucky, were nearly wiped out. The Nashville District sent electricians from Wolf Creek Dam to Albany, Kentucky, with portable generators to restore power to the town's water supply plant. FDAA assigned damage surveys in thirty-five Tennessee counties to the District, and, from a field office at Cookeville, Engineer survey teams prepared 575 damage reports obligating $2.8 million. Of special interest was a contract let by White and Putnam Counties to clear debris from the Falling Water River, where trees felled by the tornado that followed the course of the stream for nine miles threatened to clog the stream and cause flooding.

Less than a year after the tornadoes crossed the basin, a rainstorm parked over the entire Cumberland River basin from March 11 to 14, 1975, dropping at least four inches of rain on the basin and up to ten inches of rain in the central section near Stone's River. The unprecedented storm generated flood flows that were the maximum of record on many uncontrolled streams and would have been the maximum of record on the main stem of the Cumberland had it not been for the operation of the flood control reservoirs.

At Nashville, the Cumberland was above flood stage six and a half days, cresting at 47.64 feet on March 15.

The "Day of the Hundred Tornadoes"

Nashville during the March 1975 flood; downtown in background. The flood would have risen an additional 7.8 feet had it not been regulated by flood control dams.

Smithland, Kentucky, at the mouth of Cumberland River during the March 1975 flood.

Without the reservoirs, it would have climbed 7.8 feet higher at Nashville, to a 55.4-foot stage, and would have remained above flood stage 15.5 days. Flood damages in the Cumberland basin reached $17.9 million; were it not for the Nashville District flood control projects, damages would have amounted to nearly $150 million.

During the flood, District personnel boated people to safety and supplied pumps, sandbags, and technical assistance to communities fighting to protect themselves from flooding. A dramatic flood fight took place at Smithland, Kentucky, where the Corps furnished sandbags, pumps, and help to the townspeople in building a levee and pumping out water. Waves actually lapped over the bags during the several days the river was at crest, but the town was saved from inundation. After the flood, Nashville District survey teams completed damage reports in forty-five Tennessee counties, obligating $6 million.

The Nashville District had a year of respite from disaster work in 1976, but compensation came in 1977: about 250 District personnel were involved in four major disasters. During January, District personnel were called to northern Ohio to administer snow removal contracts for opening roads into communities and families isolated by the record cold and snow of the winter of 1977. In July, personnel went to Johnstown, Pennsylvania, to help clean up the mess left there by twelve inches of rain in eight hours. And within the District there was a major flood in April in the upper Cumberland and Tennessee basin, followed in

November by devastating floods in the French Broad, Holston, Clinch River basins and several basins east of the District.

The rains of April 2-5, 1977, ranging up to fifteen inches in total precipitation, sent seething floods down streams in eastern Kentucky and Tennessee, southwest Virginia, and West Virginia. On the Powell River in Lee County, Virginia, for instance, the April flood crested an estimated ten feet higher than all previous records. The stage had to be estimated because the measuring devices were overtopped.

The floods on the Upper Cumberland in Kentucky severely damaged unprotected communities and overtopped the flood protection levee at Pineville. District Engineer Henry Hatch declared a flood emergency, the District's Emergency Operations Center (EOC) mobilized, and crews with boats went to Pineville and Barboursville to help with rescue and delivery of supplies to people in upper stories who refused to evacuate.

It was apparent that the flood would also overtop the levee at Barboursville, but the District recommended that the town make a flood fight, sandbagging the low areas of the levee. Just four hours before it was predicted the levee would be overtopped, Barboursville began its flood fight with Corps advisors on the scene to help. Using sandbags furnished by the Corps, the townspeople filled the bags with sand delivered in cement-mixing trucks to speed up the operations.

The journal of a Lake Cumberland ranger who gave technical assistance at Barboursville during the flood fight tells the story:

Engineers directing the flood fight at Smithland, March 1975.

Barboursville, Kentucky, during the April 1977 flood.

Sandbagging the Barboursville levee, April 1977.

Williamsburg, Kentucky, April 1977 flood.

TIME	GAGE	REMARKS
5 April 1978		
1700	44.65	45 tons of sand arrive
2000	45.29	Waiting on the river. Reinforcing sandbags. At least 200 volunteers and National Guard on levee sandbagging.
2100	45.46	Still rising; relay to EOC Nashville; 500 men on levee.
2200	45.59	Still rising; relay to EOC Nashville, 500 men.
2300	45.71	Seven critical areas on levee. Immediate evacuation signal will be one long and three short on fire alarm. Do not wait; leave at once upon signal.
2400	45.81	Upon sandbags as high as 2 feet. Those slumps and low spots on the levee giving us a hard time.
6 April 1977		
0100	45.87	Rise slowing down. Sandbag crews still going.
0200	45.90	Rise slowing down even more.
0300	45.91	Crest—We beat the river!!!
0400	45.91	Crest.
0500	45.91	Crest.
0600	45.86	Dropping.
0700	45.65	Dropping.
0800	45.50	Inspect entire levee.

Barboursville was saved, but many other towns were not. A major disaster was declared in parts of Kentucky, Virginia, West Virginia, and Tennessee, and FDAA assigned the Nashville District the missions of completing damage survey reports for East Tennessee and constructing mobile home sites in southwestern Virginia.

By April 10, the District's damage survey teams had motored across most of East Tennessee to inspect flood damages, chiefly in the Clinch and Powell River valleys. From a disaster field office at Abingdon, Virginia, damages in thirteen counties were assessed. The Abingdon team then contracted for the construction of 428 mobile home sites, complete with utility services and access roads. The Department of Housing and Urban Development (HUD) moved mobile homes onto those sites to furnish temporary housing for those who lost their homes to the floods. In May there was a delayed Declaration for Tennessee for the same storm for several counties in the eastern portion.

Recovery from the April floods had scarcely been completed before the District's disaster operations specialists were called to the Pittsburgh Engineer District to assist with recovery from the July 20 flood at Johnstown, Pennsylvania. And they were hardly back at Nashville when a terrific rainstorm on the weekend of November 4-6, dropped from five to eleven inches of rain on East Tennessee and western Virginia and North Carolina, with a concentration of thirteen inches in several areas of North Carolina. It was the same storm that caused the failure of Kelly Barnes Lake Dam at Toccoa, Georgia, resulting in 39 fatalities (and also prompted the funding by President Carter for the national dam safety inspection program initially authorized in 1972).

After President Jimmy Carter issued a "major disaster" declaration, the FDAA assigned damage surveys in Tennessee and North Carolina to the Nashville District. The District established field offices at Johnson City, Tennessee, and Asheville, North Carolina, and the damage survey teams began crisscrossing the area.

Inspection revealed that the gaps left by the destruction of over 1,000 bridges presented the greatest obstacles on the road to recovery. In mountainous East Tennessee and Western North Carolina, roads commonly follow one side of narrow stream valleys and people build their homes on the other side of the valleys, constructing their own bridge across the stream to reach the public road. The hillside homes had remained intact, but the November floods had destroyed the bridges. With winter fast approaching, the home owners had no way to haul in supplies or fuel oil for heating. The FDAA had the choice of furnishing temporary housing for the isolated families, or of restoring the bridges, and it chose the latter as the most economical solution.

The flood on Sandymush Creek in Buncombe County, N. C., in November 1977 left only the alcove of this church standing.

At the request of the FDAA on November 14, General John W. Morris, Chief of Engineers, accepted the mission and committed the Engineers to rapid restoration of the private access bridges. Most of the destroyed bridges were single-span—foot-bridges, low-water bridges, and light traffic spans—scattered throughout the high valleys of western North Carolina; the replacements were to be low-cost temporary structures, built mostly of timber. Hundreds of the simple structures had to be rebuilt, and in a hurry.

Colonel Robert Tener and the Nashville District staff studied several ways to meet the challenge, even considering employing local labor as the District had done in 1916 to build the bridges. The final decision was to let the bridge reconstruction to contractors, mostly to small businessmen living in the disaster region.

The Nashville District committed 130 men and women, including personnel from other Districts, to the bridge building task, expanding the main office at Asheville and establishing four area offices staffed by from twelve to twenty-two people at Burnsville, Asheville, Boone, and Jefferson, North Carolina. Personnel at those offices prepared designs for simple temporary bridges, prepared bid packages, awarded contracts, and inspected construction.

"The whole name of the game is getting people back to their homes," said General E. R. Heiberg III, Ohio River Division Engineer, during his Thanksgiving inspection of the disaster area. "That's the long and short of it. The idea is to get them back in their homes,

Private access low water bridge built under Corps contract on Cane River in Yancey County, N. C. December 1977.

Building a temporary access bridge in North Carolina, winter of 1977-78.

Counties - 16
Area in Square Miles - 7,220
Population (1970) - 674,789

through temporary access, rather than keeping them in temporary housing."

The Engineers had the first bridges open to traffic within a week of the date that FDAA assigned them the mission, and work continued at top-speed under ice and snow conditions to open access to the isolated families for the delivery of heating fuel. Most bridges were open by Christmas, the remainder by February 1978. A total of 530 bridges serving 826 families were built.

The editors of the Asheville, North Carolina, *Citizen-Times* newspaper were impressed by the swift response of the Army Engineers to the disaster. In a December 4, 1977, editorial, they summarized their sentiments about the Corps of Engineers, and their comments also summarize public opinion about the recent history of the Nashville Engineer District. They wrote:

> In recent years the Corps has been the target of some heavy criticism, most of it concerning environmental considerations.
>
> The most restrained critics have accused it of being slow to take ecological matters into account when it plans a large project.
>
> Its less inhibited detractors have pictured the Corps as ruthlessly ravaging the landscape by throwing up unwanted dams and reservoirs as part of a conspiracy to aggrandize the role of the Corps in American society.
>
> The Corps probably has been slow to take account of environmental considerations in some of its planning.
>
> But it should be remembered that the Corps is entirely dependent on Congress for every dime it spends on its projects.
>
> And Congress can shut down any project it dislikes simply by withholding funding for that project.
>
> So, if the Corps has been wrong in the past, it seems likely that Congress must have been wrong, too.
>
> And who elects Congress?
>
> Before we take a stick to the Corps, we better be sure we're beating the right donkey.
>
> In any case, environment or no, the Corps is a mighty handy outfit to have around when disaster strikes and a lot of Western North Carolina residents are finding that out now.

APPENDIX A

CHRONOLOGY OF COMMAND, DISTRICT ENGINEERS OF NASHVILLE DISTRICT, CHATTANOOGA DISTRICT, AND DIVISION ENGINEERS

I. PRIOR TO FORMAL ORGANIZATION OF DISTRICTS AND DIVISIONS

CUMBERLAND RIVER	TENNESSEE RIVER
1769—mapped by LT Thomas Hutchins, British Army Engineer	1769—mapped by LT Thomas Hutchins, British Army Engineer
1832—survey of Lower Cumberland by CAPT. Richard Delafield and H. M. Shreve	1832—survey of Upper Tennessee by COL Stephen H. Long
1832-39—Superintendent William McKnight (at Nashville)	1852-54—LT COL John McClellan (at Knoxville
1870—MG Godfrey Weitzel (at Louisville)	1867—MG Godfrey Weitzel (at Louisville)
May 2, 1873—MAJ Walter McFarland (at Chattanooga)	May 24, 1871—MAJ Walter McFarland (at Chattanooga)
May 15, 1876—MAJ William R. King (at Chattanooga)	May 15, 1876—MAJ William R. King
March 20, 1886—LT COL John W. Barlow (at Chattanooga)	March 20, 1886—LT COL John W. Barlow

II. AFTER ORGANIZATION OF DISTRICTS AND DIVISIONS

NASHVILLE DISTRICT	CHATTANOOGA DISTRICT	DIVISION
Aug. 18, 1888—LT COL John W. Barlow	Aug. 18, 1888—LT COL John W. Barlow (at Nashville)	1888—COL Cyrus B. Comstock
Oct. 23, 1891—LT COL Henry M. Robert	Oct. 23, 1891—LT COL Henry M. Robert	
June 9, 1893—CAPT John Biddle	June 9, 1893—CAPT John Biddle	
	1895—CAPT Theodore A. Bingham assigned to Chattanooga.	Feb., 1895—COL Henry M. Robert

	July 10, 1895—LT James F. McIndoc (acting)	
	Nov. 21, 1895—MAJ. Dan C. Kingman	Dec., 1895—COL John W. Barlow
June 1, 1898—MAJ Dan C. Kingman (at Chattanooga)		May, 1897—COL Henry M. Robert
March 31, 1899—LT COL Milton B. Adams (at Nashville)	May 2, 1901—MAJ John G. D. Knight	May, 1901—COL Amos Stickney
July 17, 1901—MAJ John G. D. Knight (acting)		July, 1901—COL Thomas H. Handbury
Sept. 17, 1901—LT COL Milton B. Adams	April 25, 1903—CAPT William J. Barden	
April 22, 1902—CAPT William J. Barden		
July 23, 1902—LT COL Clinton B. Sears	May 31, 1904—MAJ H. C. Newcomer	
Aug. 10, 1904—MAJ H. C. Newcomer		Oct., 1904—LT COL Clinton B. Sears

1904-1919—COMMAND OF THE TWO DISTRICTS CONSOLIDATED

NASHVILLE DISTRICT	CHATTANOOGA DISTRICT	DIVISION
Feb. 25, 1907—LT W. G. Caples (acting)		July, 1906—COL E. H. Ruffner
June 18, 1907—COL W. W. Harts		Feb., 1908—COL. W. T. Rossell
July 18, 1910—MAJ C. A. F. Flagler (acting)		Sept., 1909—LT COL J. G. Warren
Dec. 8, 1910—COL. W. W. Harts		June, 1910—LT COL H. C. Newcomer
July 24, 1911—MAJ C. A. F. Flagler (acting)		
Oct. 21, 1911—MAJ Edgar Jadwin		Nov., 1914—LT COL William L. Sibert
Dec. 11, 1911—MAJ Harry Burgess		
July 22, 1916—CAPT Jarvis J. Bain		March, 1915—LT COL Henry Jervey
Sept. 26, 1916—MAJ Lytle Brown		
May 1, 1917—CAPT Jarvis J. Bain		July, 1915—COL Lansing H. Beach
Sept. 15, 1917—MR Walter S. Winn		
May 13, 1918—MR Anson B. McGrew		
April 27, 1919—COL J. B. Cavanaugh		
July 12, 1919—LT COL Lytle Brown		

NASHVILLE DISTRICT	CHATTANOOGA DISTRICT	DIVISION
Aug., 12, 1919—MAJ Robert R. Ralston	July 31, 1920—MAJ H. C. Fiske	May, 1920—COL Meriwether L. Walker
Aug. 16, 1920—MAJ H. C. Fiske		
Oct. 31, 1920—MAJ Julian S. Schley		Sept., 1920—COL W. W. Harts
Aug. 13, 1921—LT COL J. R. Slattery		
Feb. 19, 1923—MAJ H. C. Fiske		Oct., 1921—COL C. W. Kutz
Jan. 23, 1924—LT COL Elliott J. Dent		
April 20, 1925—MAJ H. C. Fiske		
Sept. 30, 1926—MAJ Lewis H. Watkins	Sept. 30, 1926—MAJ Lewis H. Watkins	May, 1928—COL Harley B. Ferguson
March 31, 1929—MAJ John F. Conklin	March 31, 1929—MAJ John F. Conklin	Oct., 1929—LT COL G. R. Spalding
Aug. 2, 1929—MAJ Frank S. Besson	Aug. 2, 1929—MAJ Frank S. Besson	May, 1933—LT COL R. C. Moore (a)
July 25, 1933—MAJ R. R. Neyland	July 25, 1933—MAJ R. R. Neyland	July, 1933—LT COL G. R. Spalding
	Aug. 1, 1933—Chattanooga District abolished	Nov., 1933—LT COL E. L. Daley
March 6, 1934—MAJ C. E. Perry		Dec., 1933—LT COL R. G. Powell
March 15, 1938—MAJ Bernard Smith		Oct., 1938—COL E. H. Marks
April 15, 1940—COL O. E. Walsh		April, 1941—LT COL L. D. Worsham (a)
Feb. 1, 1943—LT COL W. A. Davis		May, 1941—COL C. L. Hall
Dec. 28, 1943—COL Reading Wilkinson		Sept., 1945—COL B. C. Dunn
Oct. 31, 1946—COL H. V. Canan		Nov., 1946—BG D. L. Weart
Oct. 1, 1949—COL Arthur W. Pence		May, 1948—COL A. M. Neilson (a)
June 1, 1950—LT COL E. H. Dillon (acting)		July, 1948—MG J. C. Mehaffey

July 15, 1950—COL Henry Walsh
May 12, 1952—LT COL R. W. Lockridge (acting)
Aug. 2, 1952—LT COL E. B. Jennings (acting)
Aug.6 1952—COL Gilbert M. Dorland
July 1, 1956—LT COL Max C. Tyler (acting)
July 10, 1956—COL Eugene J. Stann
July 21, 1959—COL Vincent P. Carlson
July 6, 1962—COL James B. Newman III
July 8, 1965—COL Jesse L. Fishback
July 29, 1968—COL John C. Bell
June 19, 1971—COL William F. Brandes
Aug. 29, 1974—COL Henry J. Hatch
July 17, 1977—COL Robert K. Tener

Dec., 1949—MG Hugh J. Casey
Jan., 1950—COL C. P. Hardy (a)
June, 1950—BG Arthur W. Pence
April, 1951—COL C. P. Hardy (a)
Oct., 1951—BG Arthur W. Pence
Nov., 1951—COL C. P. Hardy (a)
Dec., 1951—COL Paschal N. Strong
July, 1954—BG John L. Person
Aug., 1956—COL R. E. Smyser, Jr.
Aug., 1958—BG W. W. Lapsley
Nov., 1960—COL C. L. Landaker (a)
Feb., 1961—BG Jackson Graham
Feb., 1963—COL R. W. Lockridge (a)
April, 1963—BG W. P. Leber
June, 1966—COL John C. H. Lee, Jr. (a)
Oct., 1966—BG Willard Roper
Oct., 1967—COL John A. Graf (a)
Sept., 1968—COL John C. H. Lee, Jr.
Nov., 1968—BG Willard Roper
Aug., 1970—MG William L. Starnes
Sept., 1973—BG Wayne S. Nichols
Spet., 1975—BG E. R. Heiberg III

APPENDIX B

MERITORIOUS SERVICE CITATION

NASHVILLE DISTRICT
CORPOS OF ENGINEERS, U. S. ARMY

AWARDED TO:	YEARS SERVICE:
Bowman, James I. (Bill)	1932-1961
Brooks, John H.	1921-1924
	1941-1964
Butler, John S.	1894-1920
Carter, Alice Lenora	1893-1931
Cone, Victor Mann	1928-1953
Crossman, Christian C.	1932-1971
Dennison, John T.	1939-1969
Gaines, Frank P	1933-1973
Hackett, Charles Marcus	1919-1939
Harbison, Walter Francis	1912-1944
Hooper, Hugh Braxton	1909-1939
Irwin, John C.	1893-1918
Klinger, Clarence D.	1896-1942
Osborne, Hardy Miles, Sr.	1900-1945
Prados, Gustave O.	1934-1964
Shute, John Branch	1895-1943
Smith, Harry Clarence	1913-1932
Thau, August D.	1933-1972
Thompson, James	1895-1945
Walker, John Simpson	1891-1922
Wakley, Samuel Anderson	1911-1949
Wolf, Fred H.	1933-1970
Wright, Joseph	1895-1939

NOTES

CHAPTER 1: EARLY TWIN RIVER NAVIGATION

1 Thomas D. Clark, *Frontier America: The Story of the Westward Movement* (2nd ed.: New York, 1969), pp. 93-96 (cited hereinafter as Clark, *Frontier America*); Harriette Simpson Arnow, *Seedtime on the Cumberland* (New York, 1960), pp. 157-71.

2 Thomas Hutchins, *A Topographical Description of Virginia, Pennsylvania, Maryland, and North Carolina* (Cleveland, 1904), pp. 7-51 (cited hereinafter as Hutchins, *Topographical Description*), is a reprint of the 1778 London edition, plus a short biography of Hutchins by Frederick C. Hicks, a bibliography of Hutchins' works, and a copy of his map of the Ohio River basin.

3 *Ibid.*, pp. 17-18; Clarence Alvord and Clarence E. Carter, eds., *Trade and Politics, 1767-1769* (Springfield, Ill., 1921), Vol. XVI: *Collections of Illinois State Historical Library*, p. 322 (cited hereinafter as Alvord and Carter, eds., *Trade and Politics*).

4 Thomas Gage to Lord Shelburne, April 24, 1768, *ibid.*, pp. 267-68.

5 George Morgan to Baynton, Wharton and Morgan, October 30, 1768, *ibid.*, p. 440; Thomas Hutchins to John Wilkins, July 29, 1769, *ibid.*, pp. 571-73; George Butricke to Thomas Barnsley, February 12, 1769, *ibid.*, pp. 498-99.

6 Thomas Hutchins Papers, Historical Society of Pennsylvania, Philadelphia, Pennsylvania. The Hutchins journals are replete with compass readings, estimated distances in "chains," roughly sketched maps, and notations of topographic and hydrographic features. Materials relating to Cumberland and Tennessee rivers indicate Hutchins probably traveled on the Cumberland during his patrols, but acquired his information about the Tennessee from others.

7 Hutchins, *Topographical Description*, pp. 101-02.

8 *Ibid.*, pp. 102-03.

9 *Ibid.*, pp. 19-22; Thomas Gage to Earl of Hillsborough, October 1, 1771, and Thomas Gage to Earl of Dartmouth, March 3, 1773, Clarence E. Carter, ed., *The Correspondence of General Thomas Gage with the Secretaries of States, 1763-1775* (2 vols.; New Haven, 1931), I, 309-10, 347. General Gage said Hutchins in a patrol boat on the Ohio had a narrow escape from Indian attack in July of 1771; see *ibid.*, p. 309.

10 Hutchins, *Topographical Description*, pp. 23-24. Transcripts of correspondence between Hutchins and the American agents, which was taken from him by British officials upon his incarceration, are in British Transcripts (Public Records Office, Colonial Office, Colonial 5, Vol. 7), Manuscript Division, Library of Congress.

11 Benjamin Franklin to President of Congress, March 16, 1780, in John Bigelow, ed., *The Works of Benjamin Franklin* (12 vols.; New York, 1904), VIII, 203-04.

12 Hutchins, *Topographical Description*, pp. 26-51; Clark, *Frontier America*, p. 148; Charles Whittlesey, "Origin of the American System of Land Surveys: Justice to the Memory of Thomas Hutchins," *Journal of the Association of Engineering Societies*, III (September, 1884), 275-80.

13 George Washington to Thomas Hutchins, August 20, 1786, as quoted in Hutchins, *Topographical Description*, p. 45; account of Hutchins' death on pp. 46-51.

14 Edward Burr, "Historical Sketch of the Corps of Engineers, U. S. Army," *Occasional Papers of the Engineer School*, No. 71 (1939), 34 (cited hereinafter as Burr, "Historical Sketch of the Corps of Engineers"), refers to Hutchins as first Chief of Topographical Engineers.

15 Leland D. Baldwin, *The Keelboat Age on Western Waters* (Pittsburg, 1941), p. 41 (cited hereinafter as Baldwin, *Keelboat Age*).

16 Henry Timberlake, *Memoirs, 1756-1765*, ed. by Samuel C. Williams (Johnson City, Tenn., 1927), pp. 36-58, 84-85.

17 Hutchins, *Topographical Description*, pp. 103-04; J. G. M. Ramsey, *The Annals of Tennessee to the End of the Eighteenth Century* (reprint of 1853 ed.; Kingsport, Tenn., 1926), pp. 192-93 (cited hereinafter as Ramsey, *Annals of Tennessee*).

18 Clark, *Frontier America*, pp. 134-35; John Donelson's Journal is in the collection of the Tennessee Historical Society, Nashville; the most convenient printing is Tennessee Historical Commission, *Three Pioneer Tennessee Documents: Donelson's Journal, Cumberland Compact, Minutes of Cumberland Court* (Nashville, 1964), pp. 1-10.

19 Tennessee Historical Commission, *ibid.*

20 *Ibid.*

21 *Ibid.*

22 *Ibid.*

23 *Ibid.*

24 *Ibid.*

25 *Ibid.*

26 Tennessee Valley Authority, *The Tennessee River Navigation System: History, Development, and Operation* (Knoxville, 1964), p. 13 (cited hereinafter as TVA, *Tennessee River Navigation*); Ramsey, *Annals of Tennessee*, pp. 496, 506; Mary Verhoeff, *The Kentucky River Navigation* (Louisville, 1917), p. 69 (cited hereinafter as Verhoeff, *Kentucky River*); Joseph D. Applewhite, "Early

Trade and Navigation on the Cumberland River" (unpublished master's thesis, Vanderbilt University, 1940), p. 30 (cited hereinafter as Applewhite, "Early Trade and Navigation"); John D. Barbee, "Navigation and River Improvement in Middle Tennessee, 1807-1834" (unpublished master's thesis, Vanderbilt University, 1934), p. 11 (cited hereinafter as Barbee, "Navigation and River Improvement").

[27] Baldwin, *Keelboat Age*, p. 47, 193-95; Charles H. Ambler, *A History of Transportation in the Ohio Valley* (Glendale, Calif., 1932), pp. 41-42 (cited hereinafter as Ambler, *Transportation in the Ohio Valley*).

[28] Ambler, *ibid.*; Louis C. Hunter, *Steamboats on the Western Rivers: An Economic and Technical History* (Cambridge, Mass., 1949), pp. 54-55 (cited hereinafter as Hunter, *Steamboats on the Western Rivers*); Harry H. Gauding, "A History of Water Transportation in East Tennessee Prior to the Civil War" (unpublished master's thesis, University of Tennessee, 1933), pp. 16-18 (cited hereinafter as Gauding, "Water Transportation in East Tennessee").

[29] Francois Andre Michaux, *Travels to the West of the Alleghany Mountains,* Vol. III of *Early Western Travels, 1748-1846,* ed. by R. G. Thwaites (Cleveland, 1904), p. 166 (cited hereinafter as Michaux, *Travels*).

[30] Baldwin, *Keelboat Age,* pp. 186-78; Timothy Flint *Recollections of the Last Ten Years. Passed in Occasional Residences and Journeyings in the Valley of the Mississippi* (reprint of 1826 ed.; New York, 1968), p. 105 (cited hereinafter as Flint, *Recollections*).

[31] Noah Ludlow, *Dramatic Life As I Found It* (reprint of 1880 ed.; New York, 1966), pp. 105-13 (cited hereinafter as Ludlow, *Dramatic Life*).

[32] *Ibid.*, pp. 118, 123-24.

[33] Baldwin, *Keelboat Age*, pp. 117-18; Emerson W. Gould, *Fifty Years on the Mississippi* (St. Louis, 1889), pp. 45-47.

[34] Gould, *ibid.*, pp. 124-29; Dawson A. Phelps, "The Natchez Trace in Tennessee History," *Tennessee Historical Quarterly*, XIII (September, 1954), 195-203.

[35] Applewhite, "Early Trade and Navigation," pp. 32-42; Clarice P. Ramey, "History of Pulaski County" (unpublished master's thesis, University of Kentucky, 1935), pp. 50-51; "An Account of Contingent Expenses," John S. Bassett, ed., *Correspondence of Andrew Jackson* (7 vols.; Washington, 1926-35), I, 15; Gordon T. Chappell, "The Life and Activities of General John Coffee," *Tennessee Historical Quarterly*, I (June, 1942), 125-46; Ethel C. Leahy, *Who's Who on the Ohio River and Its Tributaries* (Cincinnati, 1931), p. 166 (cited hereinafter as Leahy, *Who's Who on Ohio River*), quotes from Zadok Cramer, *The Navigator* (8th ed, Pittsburgh, 1814).

[36] See navigability reports in Waterways Management Branch, Operations Division, Nashville Engineer District.

[37] Andrew Jackson to John Hutchings, March 17, 1804, and Andrew Jackson to John Coffee, May 13, 1804, Bassett, ed., *Correspondence of Andrew Jackson*, I, 84-86, 93-95; "Flats and Barges at New Orleans," Record Group 36, National Archives.

[38] Baldwin, *Keelboat Age*, pp. 44-45, 62-45; Ludlow, *Dramatic Life*, p. 55.

[39] Flint, *Recollections*, pp. 24-25.

[40] *Ibid.*, pp. 86-91; Baldwin, *Keelboat Age*, pp. 64-65.

[41] Flint, *Recollections*, pp. 15-16.

[42] Barbee, "Navigation and River Improvement," pp. 8-11; Applewhite, "Early Trade and Navigation," pp. 43-44; *Nashville Review*, June 16, 1809, quoted in Samuel A. Weakley, "Cumberland River Floods since the Settlement of the Basin with Special Reference to Nashville, Tennessee" (unpublished C. E. thesis, Vanderbilt University, 1935), p. 26 (cited hereinafter as Weakley, "Cumberland River Floods"); Byrd Douglas, *Steamboatin' on the Cumberland* (Nashville, 1961), xiv-xv, 17-18 (cited hereinafter as Douglas, *Steamboatin'*); Baldwin, *Keelboat Age*, p. 180.

[46] *Ibid.*

[47] Ramsey, *Annals of Tennessee,* p. 686; Thomas J. Campbell, *The Upper Tennessee: Comprehending Desultory Records of River Operations in the Tennessee Valley, Covering a Period of One Hundred Fifty Years, Including Pen and Camera Pictures of the Hardy Craft and the Colorful Characters Who Navigated Them* (Chattanooga, 1932), p. 5 (cited hereinafter as Campbell, *Upper Tennessee);* (see also navigability reports, Waterways Management Branch, Operations Division, Nashville Engineer District.

[48] Michaux, *Travels,* pp. 265-66, 281-82.

[49] See navigability reports, Waterways Management Branch, Operations Division, Nashville Engineer District.

[50] *Ibid.*

CHAPTER 2: IMPROVEMENT EFFORTS OF THE STATES

[1] Baldwin, *Keelboat Age*, pp. 72-73.

[2] *Ibid.*, pp. 77-78.

[3] Stanley J. Folmsbee, *Sectionalism and Internal Improvements in Tennessee, 1796-1845* (Philadelphia, 1939), pp. 25-26 (cited hereinafter as Folmsbee, *Improvements in Tennessee*); Barbee, "Navigation and River Improvement," pp. 38-39.

[4] "Navigation on Red River, 1812," *Tennessee Historical Magazine*, Series II, III (October, 1932), 129.

[5] Barbee, "Navigation and River Improvement," pp. 38-39.

[6] *Ibid.*; W. P. Titus, *Picturesque Clarksville, Past and Present* (Clarksville, 1887), pp. 225-27; Ursula Smith Beach, *Along the Warioto, or a History of Montgomery County, Tennessee* (Nashville, 1964); pp. 125-26.

[7] See Stone's River navigability report, Waterways Management Branch, Operations Division, Nashville Engineer District.

[8] Robert H. White, ed., *Messages of the Governors of Tennessee* (7 vols.; Nashville, 1952-67), I, 98-99, 108-10 (cited hereinafter as White, ed., *Messages of Governors*).

[9] TVA, *Tennessee River Navigation*, p. 20; Gauding, "Water Transportation in East Tennessee," pp. 41-42; Nolichucky River Navigability Report, Waterways Management Branch, Operations Division, Nashville Engineer District.

[10] Gauding, "Water Transportation in East Tennessee," pp. 41-42; White, ed., *Messages of Governors*, I, 451 (see also pp. 483-84, 532, 640).

[11] *Knoxville Register*, July 6, 1819, and July 27, 1819, as quoted in Gauding, "Water Transportation in East Tennessee," p. 44, and in Folmsbee, *Improvements in Tennessee*, p. 28.

[12] Verhoeff, *The Kentucky River*, p. 23.

[13] Edward C. Betts, *Early History of Huntsville, Alabama, 1804-1870* (Montgomery, 1916), pp. 34, 61-70 (cited hereinafter as Betts, *Huntsville*); William E. Martin, *Internal Improvements in Alabama*

(Baltimore, 1902), *Johns Hopkins University Studies in History and Political Science*, Series XX, No. 4, 34-41 (cited hereinafter as Martin, *Internal Improvements*).

[14]Betts, *Huntsville*, pp. 61-62; W. Nichols to Gabriel Moore, January 9, 1830, "Letters Received by the Topographical Bureau of the War Department, 1824-65," Records of the Office of the Chief of Engineers, Record Group 77, Office of Military Archives, National Archives, Washington, D. C. (Records of the Office of the Chief of Engineers cited hereinafter as NA, RG 77).

[15]Nina Leftwich, *Two Hundred Years at Muscle Shoals: Being an Authentic History of Colbert County, 1700-1900* (Tuscumbia, Ala., 1935), pp. 67-68 (cited hereinafter as Leftwich, *Two Hundred Years at Muscle Shoals*).

[16]Hunter, *Steamboats on the Western Rivers*, pp. 5-6.

[17]Hunter, *ibid.*, is authoritative on matters relating to steamboat history. For Shreve's contributions, see also Baldwin, *Keelboat Age*, pp. 192-93; Campbell, *Upper Tennessee*, pp. 9-10; TVA, *Tennessee River Navigation*, p. 15; and Florence Dorsey, *Master of the Mississippi: Henry Shreve and the Conquest of the Mississippi* (Boston, 1941; cited hereinafter as Dorsey, *Master of the Mississippi*).

[18]Douglas, *Steamboatin'*, pp. 4-7.

[19]*Ibid.*, pp. 4-11; Applewhite, "Early Trade and Navigation," pp. 78-79, 82, 117.

[20]Ludlow, *Dramatic Life*, pp. 238-40.

[21]*Ibid.*

[22]Flint, *Recollections*, pp. 108-09.

[23]Paducah *Sun-Democrat*, August 1966, prints a series of articles on the subject in *Hal Allen's Notebook;* see also Applewhite, "Early Trade and Navigation," p. 116.

[24]Ambler, *Transportation in the Ohio Valley*, pp. 153-54; Walter Havighurst, *Voices on the River: The Story of the Mississippi Waterway* (New York, 1964), p. 60 (cited hereinafter as Havighurst, *Voices on the River*).

[25]Ramey, "History of Pulaski County," pp. 115-17; *National Banner and Nashville Daily Advertiser*, March 4, 1833; Douglas, *Steamboatin'*, p. 35.

[26]Havighurst, *Voices on the River*, p. 60; *Nashville Whig*, January 24, 1825; Barbee, "Navigation and River Improvement," p. 58.

[27]Ambler, *Transportation in the Ohio Valley*, pp. 153-54, quotes Pittsburgh *Gazette*, January 1, 1830.

[28]Douglas, *Steamboatin'*, p. 14; Barbee, "Navigation and River Improvement," p. 49.

[29]Douglas, *Steamboatin'*, p. 9; Folmsbee, *Improvements in Tennessee*, pp. 12-13.

[30]Gilbert Dorland, address to Florence (Alabama) Rotary Club, January 9, 1956, Nashville District Historical File, Corps of Engineers Office, Nashville, Tennessee (cited hereinafter as NDHF); Leftwich, *Two Hundred Years at Muscle Shoals*, pp. 81-82; Campbell, *Upper Tennessee*, pp. 27-29; TVA, *Tennessee River Navigation*, pp. 15-16; Havighurst, *Voices on the River*, p. 60.

[31]Havighurst, *Voices on the River*, pp. 101-03; W. B. Hesseltine, ed., *Dr. J. G. M. Ramsey: Autobiography and Letters* (Nashville, 1954), pp. 18-19; Gauding, "Water Transportation in East Tennessee," p. 80.

[32]Barbee, "Navigation and River Improvement," pp. 70-72; Folmsbee, *Improvements in Tennessee*, pp. 78-79.

[33]Folmsbee, *Improvements in Tennessee*, pp. 80-81; Charles N. Branham and Norton B. Wilson, eds., *Register of Graduates and Former Cadets of the United States Military Academy, 1802-1960* (West Point, New York, 1960), p. 175 (cited hereinafter as *Register of Graduates, USMA*). This convenient volume of biographical sketches is annually updated and reprinted, but only the edition at the end of each decade includes biographies of all cadets. Gauding, "Water Transportation in East Tennessee," pp. 43, 47-48; Richard G. Wood, *Stephen Harriman Long, 1784-1864: Army Engineer, Explorer, Inventor* (Glendale, Calif., 1966), pp. 151-52 (cited hereinafter as Wood, *Long*).

[34]Wood, *Long*, *passim;* Leland R. Johnson, "19th Century Engineering: The Contest and Contract of 1824," *Military Engineer*, LXV (May-July, 1973), 166-71, 252-57.

[35]Solomon D. Jacobs to Topographical Bureau, March 17, 1832, "Registers of Letters Received, Topographical Bureau, 1824-66," NA, RG 77. Colonel Long's report of the survey was printed in 1875 in U. S., Congress, House, *Report on Tennessee River and Tributaries, 1832*, H. Exec. Doc. No. 167, 43 Cong., 2 Sess., 1875 (cited hereinafter as Long, *Report on Tennessee, 1832*). Board members who accompanied the expedition were William E. Cocke and David A. Deaderick; the two civilian assistant engineers were R. P. Baker and Philip Van Wyck; the three lieutenants were Samuel P. Heintzelman, Francis L. Dancy, and Albert Miller Lea, *ibid.*, p. 2. Original maps made on this survey, or at least nineteenth-century handdrawn copies, still legible though mutilated and marked by Engineers who improved the same section of the Tennessee at a later date, are in the Engineering Data File, Old Map Collection, Nashville District, Corps of Engineers, and are titled: "Sketches of the Tennessee River from Knoxville to the State Line between Tennessee and Alabama, Respectfully Inscribed to the Board of Internal Improvements for East Tennessee, 1832."

[36]Long, *Report on the Tennessee, 1832*, pp. 1-7; Wood, *Long*, pp. 151-52; *Nashville Republican and State Gazette*, June 18, 1832.

[37]*Nashville Republican and State Gazette*, June 18, 1832; Long, *Report on the Tennessee, 1832*, p. 7.

[38]Long, *Report on the Tennessee, 1832*, p. 7; *Register of Graduates, USMA*, p. 179.

[39]Long, *Report on the Tennessee, 1832, passim;* see also discussion in Folmsbee, *Improvements in Tennessee*, pp. 81-82.

[40]Long, *Report on the Tennessee, 1832*, pp. 21-23.

[41]*Ibid.*

[42]*Ibid.*, pp. 20, 24-47.

[43]*Nashville Republican and State Gazette*, July 4 and August 1, 1832; Folmsbee, *Improvements in Tennessee*, p. 82.

[44]Gauding, "Water Transportation in East Tennessee," p. 48; *Nashville Republican and State Gazette*, August 31, 1833; for problems with contractors, see Board of Internal Improvements for East Tennessee, *Report of the Board of Internal Improvements for East Tennessee to the General Assembly of the State of Tennessee* (pamphlet; Nashville, 1837), *passim;* Hesseltine, ed., *Dr. J. G. M. Ramsey: Autobiography and Letters*, p. 33.

[45]Nichols Bowden, "Improving Tennessee River above Chattanooga, Tenn., by Regulation or Open-Channel Methods," *Professional Memoirs*, VI (November-December, 1914), p. 665; Holston River Navigability Report, Waterways Management Branch, Operations Division, Nashvile Engineer District.

[46]Folmsbee, *Improvements in Tennessee*, pp.22, 216-17; Barbee, "Navigation and River Improvement," p. 72.

[47]J. W. M. Brazeale, *Life As It Is: Or Matters and Things in General* (reprint of 1842 ed.; Nashville, 1969), pp. 178-79, 199, 200, 208.

[48]*Ibid.*, p. 200.

[49]*Ibid.*, p. 208.

[50]Folmsbee, *Improvements in Tennessee*, pp. 163, 218-20.

[51]Duck River Navigability Report, Waterways Management Branch, Operations Division, Nashville Engineer District.

[52]*Ibid.*

[53]B. R. McKennie, *Improvements for the Creation of Water Power by Means of a Dam and Lock in the Cumberland River, Three Miles above Nashville* (pamphlet; Nashville, 1841), *passim;* Douglas, *Steamboatin'*, pp. 67-68; *Tri-Weekly Nashville Union*, July 26, 1845, as quoted in Weakley, "Cumberland River Floods," pp. 65-66.

[54]Nashville *Daily Gazette*, March 22, 1850, as quoted in Weakley, "Cumberland River Floods," p. 79.

[55]*Ibid.*

CHAPTER 3: THE ENGINEERS AND THE SOUTHERN ROUTE

[1]Raleigh B. Buzzaird, "America's First Chief Engineer," *Military Engineer*, XXIX (December, 1947), 505-10.

[2]*Ibid.*

[3]W. Stull Holt, *The Office of the Chief of Engineers of the Army: Its Non-Military History, Activities, and Organization* (Baltimore, 1923), pp. 1-2 (cited hereinafter as Holt, *OCE*); Henry C. Jewett, "History of the Corps of Engineers to 1915," *Military Engineer*, XIV (September-October, November-December, 1922), 304-06, 385-88; Burr, "Historical Sketch of the Corps of Engineers," pp. 1-11, quotes McHenry on pp. 10-11; Henry P. Beers, "A History of the U. S. Topographical Engineers, 1813-1863," *Military Engineer*, XXXIV (June-July, 1942), 287-91, 348-52.

[4]Burr, "Historical Sketch of the Corps of Engineers," pp. 1-11.

[5]Holt, *OCE*, pp. 4-5; Balthasar H. Meyer and Caroline E. MacGill, *History of Transportation in the United States before 1860* (Washington, 1917), pp. 135-37; U. S., Congress, *American State Papers*, Class X: *Miscellaneous* (2 vols.; Washington, 1834), I, 724-29, prints Gallatin's Report on Internal Improvements of 1808 (*American State Papers* cited hereinafter as *ASP*, Followed by identification of series, volume, and page).

[6]*ASP*, Class X: *Miscellaneous*, I, 724-29.

[7]*Ibid.*; Carter Goodrich, "American Development Policy: The Case of Internal Improvements," *Journal of Economic History*, XVI (1956), 449-60.

[8]*ASP*, Class X: *Miscellaneous*, II, 533-37.

[9]*Ibid.*; see also Secretary Calhoun's report on roads and canals in 1824 which advocated construction of parts of the Southern Route, *ASP*, Class V: *Military Affairs* (7 vols.; Washington, 1832-61), II, 698-701.

[10]U. S. Army, Office of the Chief of Engineers, *Laws of the United States Relating to the Improvement of Rivers and Harbors, 1790-1939* (3 vols, plus 2 index vols.; Washington, 1940), I, 26-28 (cited hereinafter as *River and Harbor Laws*). This compilation conveniently prints all water resource legislation within the designated period.

[11]Wood, *Long*, pp. 145-46; John L. Vance, "The Improvement of the Ohio River," *Annals of the American Academy of Political and Social Sciences*, XXXI (January, 1908), 140-41. The term "wing dam" described low structures built to constrict water flow of a river until an order was issued in 1913 renaming such structures "spur dikes" or "longitudinal dikes" to avoid confusion with slackwater dams; see Circular No. 115, March 23, 1913, U.S.E.O., Nashville, Tennessee, Office Circulars, 1910-1915, Records of Engineer Divisions and Districts, NA, RG 77 (Microfilm Entry No. 1421; copy in NDHF).

[12]Dorsey, *Master of the Mississippi*, pp. 141-43; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress* (among other reports appended are annual reports of the Chiefs of Engineers), S. Doc. No. 1, 28 Cong., 1 Sess., 1843, pp. 207-08.

[13]U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 28 Cong., 1 Sess., 1843, pp. 207-08; *ASP*, Class V: *Military Affairs*, II, 699, 714; Wood, *Long*, p. 146; Dorsey, *Master of the Mississippi*, pp. 144-49.

[14]Dorsey, *Master of the Mississippi*, pp. 148-54.

[15]*Ibid.*; Havighurst, *Voices on the River*, pp. 70-72; Shreve's estate was eventually paid $50,000 by Congress for his invention; see *River and Harbor Laws*, I, 322.

[16]*ASP*, Class V: *Military Affairs*, IV, 167-68; Dorsey, *Master of the Mississippi*, pp. 151-56; Havighurst, *Voices on the River*, pp. 72-73. The Grand Chain of Rocks were dangerous rocky shoals studding the Ohio River channel from Baccus Landing (near Joppa, Ill.) downriver to the present site of Lock and Dam 53 at Mound City, Illinois; Jacob Baccus, private interview, August 27, 1970; Gould, *Fifty Years on the Mississippi*, p. 213.

[17]I. J. Cox, ed., "Documents Relating to Zachariah Cox," *Quarterly Publication of the Historical and Philosophical Society of Ohio*, VIII (1913), 29-114 (quote on p. 46).

[18]*Ibid.*, pp. 29-36.

[19]*Ibid.*, p. 45.

[20]*Ibid.*

[21]*Ibid.*

[22]*Ibid.*

[23]Lorenzo Dow, *Perambulations of Cosmopolite; or Travels and Labors of Lorenzo Dow in Europe and America* (New York, 1855), p. 120; see similar comment on p. 240.

[24]*Wilson's Knoxville Gazette*, February 10, 1808; Nashville *Impartial Review and Cumberland Repository*, June 6, 1807.

[25]*Wilson's Knoxville Gazette*, September 23, 1809.

[26]Applewhite, "Early Trade and Navigation," p. 102; White, ed., *Messages of Governors*, III, 168 (and illustration opposite), 261-62; see also surveys of the route in the late nineteenth century in John Jay Williams, *Tennessee and Mississippi River Canal* (Jackson, Tennessee, 1891), *passim;* Tennessee, State Commission on Improvement to Waterways, *Report of the State Commission on Improvement to Waterways. Showing the Results of Surveys of the Proposed Tennessee and Mississippi River Canal, Together with the Chief Engineer's Estimates of Its Tonnage, Revenue and Income, and Cost of Construction* (Jackson, Tennessee, 1893), *passim*.

[27]Verhoeff, *Kentucky River*, pp. 28-29, 104-06.

[28]*Ibid.*

[29]Martin, *Internal Improvements*, pp. 34-41.

[30]*ASP*, Class V: *Military Affairs*, II, 699; Holt, *OCE*, p. 6.

[31]Holt, *OCE*, p. 6; Corps of Engineers Museum, *Geneses of the Corps of Engineers* (unpaginated pamphlet; Fort Belvoir, Virginia, 1953) contains biographical sketch of Colonel Joseph Totten (cited hereinafter as CE Museum, *Geneses*); Wil-

liam H. Carter, "Bvt. Maj. Gen. Simon Bernard," *Professional Memoirs*, V (May-June, 1913), 306-14.

[32]Holt, *OCE*, pp. 6-7.

[33]William Jerome to Topographical Bureau, September 20, 1828, and May 7, 1829, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; Forest G. Hill, *Roads, Rails, & Waterways: The Army Engineers and Early Transportation* (Norman, Okla., 1957), p. 55 (cited hereinafter as Hill, *Roads, Rails, & Waterways*).

[34]Engineer Department to Hartman Bache, June 12, 1828, "Letters to Officers of Engineers, Volume III, December 11, 1826 to July 2, 1830," NA, RG 77; Hartman Bache to Topographical Bureau, July 2, 1828, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; Wood, *Long*, pp. 253-54; *Register of Graduates, USMA*. p. 174; U. S., Congress, House, *Survey of Savannah and Tennessee Rivers*, H. Exec. Doc. No. 104, 22 Cong., 1 Sess., 1832, *passim*.

[35]U. S., Congress, House, *Communication between the Hiwassee and Conesauga Rivers*, H. Exec. Doc. No. 15, 20 Cong., 2 Sess., 1828, *passim*.

[36]Montgomery *Republican*, March 3, 1821; White, ed., *Messages of Governors*, I, 654-55; Campbell, *Upper Tennessee*, p. 6; Folmsbee, *Improvements in Tennessee*, pp. 13-14, 50; Donald Davidson, *The Tennessee* (2 vols. separately titled: Vol. I: *The Old River: Frontier to Secession* and Vol. II: *The Tennessee: Civil War to TVA;* New York, 1946-48), I, 210-11; Ocoee River Navigability Report, Regulatory Functions Branch, Operations Divisions, Nashville Engineer District.

[37]Martin, *Internal Improvements*, pp. 35-38; Gauding, "Water Transportation in East Tennessee," pp. 74-76; Gilbert E. Govan and James W. Livingood, *The Chattanooga Country, 1540-1951; From Tomahawks to TVA* (New York, 1952), p. 119 (cited hereinafter as Govan and Livingood, *Chattanooga Country*); U. S., Congress, House, *Communication between the Hiwassee and Conesauga Rivers*, H. Exec. Doc. No. 15, 20 Cong., 2 Sess., 1828, *passim*.

[38]U. S., Congress, House, *Communication between the Hiwassee and Conesauga Rivers*, H. Exec. Doc. No. 15, 20 Cong., 2 Sess., 1828, *passim*.

[39]Jefferson Vail to Simon Bernard, March 22, 1828, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77.

[40]George R. Taylor, *The Transportation Revolution, 1815-1860*, Vol. IV of *The Economic History of the United States* (New York, 1951), ed. by Henry David, Harold U. Faulkner, Louis M. Hacker, Curtis P. Nettels, and Fred A. Shannon, pp. 32-55, provides information about the "canal craze"; Benjamin F Klein, ed., *The Ohio River Handbook and Picture Album* (Cincinnati, 1969), pp. 378-79, describes the canal around the Falls of the Ohio (cited hereinafter as Klein, ed., *Ohio River Handbook)*.

[41]Hill, *Roads, Rails, & Waterways*, pp. 169-71; *River and Harbor Laws*, I, 37; Simon Bernard to Topographical Bureau, August 5, 1827, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77.

[42]*River and Harbor Laws*, I, 44-45.

[43]James Kearney to Charles Gratiot, May 1, 1829, "Monthly Personal Reports of Officers, 1820-38" (Colonel Kearney's reports for January 1, 1821-May 1, 1829 in separate folder), NA, RG 77; James Kearney to Topographical Bureau, April 13, July 4, September 5, 1829, and January 14, 1830, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77.

[44]A hand-made copy, prepared in 1877 by H. J. Gielow at Chattanooga District Engineer Office, of Colonel Kearney's maps and profiles, entitled "Muscle Shoals of the Tennessee River, State of Alabama, 1829," is filed in Engineer Data File, Old Maps Collection, Nashville District, Corps of Engineers. The report is printed in U. S., Congress, House, *Report of Col. of Top. Engrs. Relative to the Surveys of the Tenn. River*, H. Doc. No. 167, 29 Cong., 1 Sess., 1846, *passim*.

[45]U.S.,Congress, House, *Report of Col. of Top. Engrs. Relative to the Surveys of the Tenn. River*, H. Doc. No. 167, 29 Cong.,1 Sess., 1846, p. 29

[46]Martin, *Internal Improvements*, p. 44; J. A. Dumeste to Topographical Bureau, June 16, August 1, September 1, December 1, 1830, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; J. A. Dumeste to Engineer Department, September 4, September 9, October 15, December 1, 1830, and August 10, 1831, "Letters Received, Volume III, Engineer Department, August 1, 1830 to December 31, 1834," NA, RG 77.

[47]Many excellent maps of Muscle Shoals clarify the nomenclature of the region; see, for example, the map prepared by Lieutenant Colonel John W. Barlow in 1890, printed in Senate Document No. 83, 59 Cong., 1 Sess., 1905.

[48]*River and Harbor Laws*, I, 54-55.

[49]Daniel H. Calhoun, *The American Civil Engineer: Origins and Conflicts* (Cambridge, Mass., 1960), pp. 37-39. Handdrawn copies of Roberts' plans were prepared by Julius Shutting at Chattanooga District Engineer Office in 1883 and are in Engineering Data File, Old Map Collection, Nashville District, Corps of Engineers. Title page of the plans reads: "Maps of the Muscle-Shoals Canal between Lamb's Ferry and Campbell's Ferry with Profiles and Cross-Sections of the Ground on which the Canal will Pass as Located by Order of the Board of Tennessee Canal Commissioners, Nathan S. Roberts, Civil Engineer, 1831."

[50]U. S., Congress, House, *Report of Col. of Top. Engrs. Relative to the Surveys of the Tenn. River*, H. Doc. No. 167, 29 Cong., 1 Sess., 1846, pp. 2-7.

[51]*Ibid.*

[52]*Western Weekly Review*, May 3, 1832, as quoted in Barbee, "Navigation and River Improvement," p. 74; U. S., Congress, House, Committee on Roads and Canals, *Canal around Colbert Shoals*, H. Rept. No. 104, 23 Cong., 2 Sess., 1835, p. 7.

[53]U. S., Congress, House, Committee on Roads and Canals, *Canal around Colbert Shoals*, H. Rept. No. 104, 23 Cong., 2 Sess., 1835, *passim; River and Harbor Laws*, I, 61-62, 64-65.

[54]U. S., Congress, House, *Report on Work Done at Muscle and Colbert Shoals*, H. Doc. No. 222, 24 Cong., 1 Sess., 1836, *passim*.

[55]*Ibid.*

[56]*River and Harbor Laws*, I, 73.

[57]U. S., Congress, House, Committee on Roads and Canals, *Canal around the Muscle Shoals of the River Tennessee*, H. Rept. No. 985, 25 Cong., 2 Sess., 1838, *passim*.

[58]*Ibid.*, pp. 14-18.

[59]*Ibid.*,p. 18.

[60]*Ibid.*,pp. 12-13.

[61]*Ibid.*,p. 6.

[62]Folmsbee, *Improvements in Tennessee*, pp. 91-92; T. D. Clark, "The Building of the Memphis and Charleston Railroad," East Tennessee Historical Society's *Publications*, No. 8 (1936), pp. 9-11; Govan and Livingood, *Chattanooga Country*, p. 122.

CHAPTER 4: THE ENGINEERS TACKLE THE TWIN RIVERS

[1]An account of a military expedition General Jackson led down the Cumberland in January of 1813 is found in "Journal of the Trip Down the Mississippi," Bassett, ed., *Correspondence of Andrew Jackson*, I, 255-71. See *ibid.*, IV, 185-86, for Jackson's opinion of internal improvements, and for discussion of his policies see Carlton Jackson, "The Internal Improvement Vetoes of Andrew Jackson," *Tennessee Historical Quarterly*, XXV (Fall, 1966), 261-79; Carlton Jackson, *Presidential Vetoes, 1792-1945* (Athens, Georgia, 1967), pp. 15-27; Edward L. Pross, "A History of Rivers and Harbors Appropriation Bills, 1866-1933" (unpublished Ph. D. dissertation, Ohio State University, 1938), p. 23 (cited hereinafter as Pross, "Rivers and Harbors Appropriation Bills").

[2]Applewhite, "Early Trade and Navigation," pp. 102-03; Folmsbee, *Improvements in Tennessee*, p. 54; *Nashville Whig*, March 18, 1826; Barbee, "Navigation and River Improvement," p. 51.

[3]Folmsbee, *Improvements in Tennessee*, p. 63.

[4]*ASP*, Class V: *Military Affairs*, V, 59, 210; Dorsey, *Master of the Mississippi*, p. 179.

[5]*River and Harbor Laws*, I, 61; Henry Shreve to Engineer Department, August 9, August 22, September 9, 1832, "Letters Received, Vol. III, Engineer Department, August 1, 1830 to December 31, 1834," NA, RG 77; Charles Gratiot to Richard Delafield, August 17, 1832, "Letters to Officers of Engineers, Vol. IV, July 6, 1830 to April 14, 1834," NA, RG 77.

[6]CE Museum, *Geneses*, n. p.; *Register of Graduates, USMA*, p. 174; *Professional Memoirs*, III (July-September, 1911) 416-17.

[7]*ASP*, Class V: *Military Affairs*, V, 47; U.S., Congress, Senate, *Message from the President of the United States showing the Operations of the Topographical Bureau during the Year 1839*, S. Doc. No. 58, 26 Cong., 1 Sess., Vol. II, 87-88; Richard Delafield to Charles Gratiot, October 3, 1832, incloses Richard Delafield and Henry M. Shreve, "Report on the Improvement that may be made in the navigation of the Cumberland River from Nashville to the Ohio." "Letters Received, 1832-1865, Engineer Department," NA, RG 77.

[8]Henry Shreve to Engineer Department, September 29, 1832, "Letters Received, Vol. III, Engineer Department, August 1, 1830 to December 31, 1834," NA, RG 77; William H. G. Bartlett to Richard Delafield, October 8, 1832, "Letters to Officers of Engineers, Vol. IV, July 6, 1830 to April 14, 1834," NA, RG 77.

[9]*Nashville Republican and State Gazette*, January 28, 1834.

[10]William McKnight to Engineer Department, October 27, 1832, and March 5, 1833, "Letters Received, Vol. III, Engineer Department, August 1, 1830 to December 31, 1834," NA, RG 77; *ASP*, Class V: *Military Affairs*, V, 187.

[11]Willaim McKnight to Engineer Department, March 29, December 15, 1833, and July 29, 1834, "Letters Received, Vol. III, Engineer Department, August 1, 1830 to December 31, 1834," NA, RG 77; *ASP*, Class V: *Military Affairs*, V, 390, 396, 414-15, 659.

[12]*ASP*, Class V: *Military Affairs*, V, 390, 396, 414-15, 659; William McKnight to Engineer Department, July 10, 1835, "Letters Received, Vol. IV, Engineer Department, January 1, 1835 to December 31, 1837," NA, RG 77. Cholera, an acute intestinal disease characterized by sudden onset, vomiting, rapid dehydration, and collapse, reached epidemic proportions during the nineteenth century in the twin valleys and elsewhere. Preventative measures—water supply purification, sanitary sewage systems, and immunization—checked the disease in the United States. Information furnished by Dr. Victor S. Falk, Medical Editor, *Wisconsin Medical Journal*.

[13]U. S., Congress, House, *Survey of Cumberland River*, H. Doc. No. 171, 23 Cong., 2 Sess., 1835, p. 2 (cited hereinafter as Stansbury, *Survey of Cumberland*).

[14]*Ibid.*; Howard Stansbury to Topographical Bureau, August 6, 1834, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; Allen Johnson, Dumas Malone, *et al.*, eds., *Dictionary of American Biography* (1964 edition, 12 vols.; New York, 1964), IX, 516; William H. Goetzmann, *Army Exploration in the American West, 1803-1863* (New Haven, 1959), pp. 219-25 (cited hereinafter as Goetzmann, *Army Exploration*).

[15]Howard Stansbury, "Map of the Cumberland River from the Falls to Nashville Made to Accompany a Report on the Improvement of that Stream for the Navigation of It by Steamboats; In Obedience to a Resolution of Congress dated April 26, 1834," in Engineering Data File, Old Map Collection, Nashville District, Corps of Engineers, is a handdrawn topographical map, possibly the original but most likely a copy made about 1875; Stansbury, *Survey of Cumberland*, pp. 19-20.

[16]Stansbury, *Survey of Cumberland*, pp. 2, 19-20.

[17]*Ibid.*, pp. 4-12; Verhoeff, *Kentucky River*, p. 178.

[18]Stansbury, *Survey of Cumberland*, p. 3.

[19]*Ibid.*,pp. 3-4.

[20]*Ibid.*,pp. 4-12.

[21]*Ibid.*,pp. 12-19; *River and Harbor Laws*, I, 81.

[22]*ASP*, Class V: *Military Affairs*, V, 454; *Register of Graduates, USMA*, p. 179; A. H. Bowman, *Remarks on Making and Applying Concrete* (pamphlet, Washington, 1849).

[23]*ASP*, Class V: *Military Affairs*, V, 414-15.

[24]*Ibid.*,VII, 693-95.

[25]*Ibid.*; William McKnight to Engineer Department, April 6, 1837, "Letters Received, Vol. IV, Engineer Department, January 1, 1835 to December 31, 1837," NA, RG 77; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress* (accompanying materials include the annual reports of the Chiefs of Engineers), S. Doc. No. 1, 25 Cong., 3 Sess., 1838, I, 230-32.

[26]U. S. Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 25 Cong., 3 Sess., 1838, I, 230-32; William McKnight to Topographical Bureau, September 4, 1838, "Letters Received, Vol. V, Engineer Department, January 1, 1838 to December 31, 1840," NA, RG 77.

[27]Holt, *OCE*, p. 8; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 25 Cong., 3 Sess., 1838, I, 107; William McKnight to Topographical Bureau, January 31, 1839, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; Wood, *Long*, pp. 189-99.

[28]William McKnight to Topographical Bureau, February 16, March 8, April 20, June 7, July 9, July 19, August 5, September 14 and 29, 1839, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; Stephen H. Long to Topographical Bureau, June 4, August 4, September 20 and 26, 1839, *ibid.*

[29] U. S., Congress, Senate, *Message from the President of the United States showing the Operations of the Topographical Bureau during the Year 1839*, S. Doc. No. 58, 26 Cong., 1 Sess., 1839, II, 85-89.

[30] *Ibid.*

[31] *Ibid.*, pp. 87, 89-91.

[32] *Ibid.*

[33] *Ibid.*

[34] William McKnight to Topographical Bureau, November 18, December 9, 1839, "Register of Letters Received, Topographical Bureau, 1824-1866," NA, RG 77; T. M. Hale to Topographical Bureau, March 26, April 16, August 17 and 26, 1840, *ibid.*; J. O. Shackelford to Topographical Bureau, June 15, July 20, November 21, 1841, *ibid.*

[35] *River and Harbor Laws*, I, 61, 68, 75, 81, 86.

[36] Dorsey, *Master of the Mississippi*, pp. 206-07; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 26 Cong., 2 Sess., 1840, p. 11, quotes Van Buren.

[37] Pross, "Rivers and Harbors Appropriation Bills," pp. 25-41; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 27 Cong., 3 Sess., 1842, p. 10, quotes John Tyler.

[38] Wood, *Long*, pp. 205-06.

[39] U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Doc. No. 1, 28 Cong., 1 Sess., 1843, I, 139, 191-98.

[40] Holt, *OCE*, p. 9; Wood, *Long*, pp. 211-17; Havighurst, *Voices on the River*, pp. 97-98; Eugene I. McCormac, *James K. Polk: A Political Biography* (2nd ed.; New York, 1965), pp. 678-80.

[41] U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Exec. Doc. No. 1, 31 Cong., 2 Sess., 1850, pp. 14-15, quotes Millard Fillmore.

[42] Holt, *OCE*, pp. 10-11; *River and Harbor Laws*, I, 124.

[43] Martin, *Internal Improvements*, pp. 35, 44; Folmsbee, *Improvements in Tennessee*, p. 222; Gauding, "Water Transportation in East Tennessee," p. 52; John McClellan to J. J. Abert, April 11, 1853, "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77.

[44] *Register of Graduates, USMA*, p. 179; Burr, "Historical Sketch of the Corps of Engineers," p. 41; Goetzmann, *Army Exploration*, pp. 169-72.

[45] *Ibid.*

[46] John McClellan to J. J. Abert, April 11 and 14, 1853, "Letters Received by the Topographical Bureau, 1824-1865." NA, RG 77.

[47] *Ibid.*

[48] *Ibid.*

[49] *Ibid.* (see clipping from *Knoxville Whig* inclosed in letter of April 11); E. W. W. King to Jefferson Davis, April 13, 1853, *ibid.*

[50] E. Merton Coulter, *William G. Brownlow, Fighting Parson of the Southern Highlands* (Chapel Hill, 1937), *passim.*

[51] W. Irving Crandall and A. B. Watkins to Jefferson Davis, June 2, 1853 (clipping from Chattanooga *Advertiser* inclosed), "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77; *Knoxville Whig*, May 28, 1853.

[52] W. M. Churchill to Jefferson Davis, June 3, 1853, "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77; John McClellan to J. J. Abert, June 30, 1853, *ibid.*

[53] John McClellan to J. J. Abert, August 6, September 1, 1853, *ibid.*;*Knoxville Whig*, July 2, 1853; U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Exec. Doc. No. 1, 33 Cong., 1 Sess., 1853, II, 96-108, prints Colonel McClellan's report of the year's operations.

[54] John McClellan to J. J. Abert, June 23, 1854, "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77.

[55] U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Exec. Doc. No. 1, 33 Cong., 1 Sess., 1853, II, 255-56.

[56] *Ibid.*, p. 197, 231, 255-56; U. S., Congress, House, *Message from the President of the United States to the Two Houses of Congress*, H. Exec. Doc. No. 1, 33 Cong., 2 Sess., 1854, pp. 299-302.

[57] U. S., Congress, Senate, *Message from the President of the United States to the Two Houses of Congress*, S. Exec. Doc. No. 1, 34 Cong., 1 Sess., 1855, pp. 465-68; John McClellan to J. J. Abert, August 10 and 22, 1854, "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77.

[58] Pross, "Rivers and Harbors Appropriation Bills," pp. 36-39; Roy Nichols, *Franklin Pierce: Young Hickory of the Granite Hills* (Philadelphia, 1958), pp. 104, 299, 354-55, 374-75; James C. Luttrell to J. J. Abert, September 2, 1854, "Letters Received by the Topographical Bureau, 1824-1865," NA, RG 77; R. McClellan to J. J. Abert, September 15, 1854, *ibid.*

[59] U. S., Congress, House, *Report on Preliminary Examination and a Partial Survey of Tennessee River and Tributaries*, H. Doc. No. 319, 67 Cong., 2 Sess., 1922, pp. 14-15.

[60] Isaac Lippincott, *A History of Manufactures in the Ohio Valley to the Year 1860* (New York, 1914), p. 642; Wood, *Long*, p. 244.

CHAPTER 5: CIVIL WAR COMBAT ENGINEERING

[1] Sketches of Civil War engineer operations are found in Philip M. Thienel, "Engineers in the Union Army, 1861-1865," *Military Engineer*, XLVII (January-February, March-April, 1955), 36-41, 110-15; William M. Robinson, Jr., "The Confederate Engineers," *Military Engineer*, XXII (July-August, September-October, November-December, 1930), 297-305, 410-19, 512-17; James L. Nichols, *Confederate Engineers* (Tuscaloosa, Ala., 1957), *Confederate Centennial Studies*, No. 5; George T. Ness, Jr., "Army Engineers of the Civil War," *Military Engineer*, LVII (January-February, 1965), 38-40. For remarks of Confederate Chief Engineer, see J. F Gilmer indorsement on correspondence, Richmond, December 7, 1862, U. S., War Department, *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies* (4 series, 70 volumes in 128; Washington, 1880-1901), Series I, Vol. LII, Pt. 1, p. 164 (cited hereinafter as *O.R.*, always Series I unless otherwise indicated).

[2] Nichols, *Confederate Engineers*, pp. 42-43; Bromfield Ridley, *Battles and Sketches of the Army of Tennessee* (Mexico, Mo., 1906), pp. 64-66; Edwin C. Bearss, "The Construction of Fort Henry and Fort Donelson," West Tennessee Historical Society *Papers*, XXI (1967), 24-47.

[3] Albert S. Johnston to Samuel Cooper, September 25, 1861, *O.R.*, IV, 426; Judah P. Benjamin to Albert S. Johnston, September 27, 1861, *ibid.*, p. 430.

[4] Nichols, *Confederate Engineers*, pp. 29-31, 43-45; Thomas L. Connelly, *Army of the Heartland:*

The Army of Tennessee, 1861-1862 (Baton Rouge, 1967), pp. 25-72; J. F. Gilmer to W. W. Mackall, November 28, December 4 and 7, 1861, *O. R.*, VII, 710, 735-36, 741. Gilmer chose G. O. Watts to direct the fortification of Nashville, Edward B. Sayers (who later joined the Confederate Engineers) to prepare the defenses of Clarksville, and T. J. Glenn to place timber obstructions in the river channel just below Fort Donelson.

[5]G. A. Henry to A. S. Johnston, November 7, 1861, *O. R.*, IV, 526; J. F. Gilmer to Joseph Dixon, December 4, 1861, *ibid.*; VII, 734-35; Joseph Dixon to J. F. Gilmer, November 21, 1861, *ibid.*, pp. 698-99.

[6]Lloyd Tilghman, Reports of February 7 and 12, 1862, *O. R.*, VII, 136-44; J. F. Gilmer to W. W. Mackall, March 17, 1862, *ibid.*, pp. 131-35.

[7]J. F. Gilmer to W. W. Mackall, March 17, 1862, *ibid.*, pp. 261-64; Edwin Bearss, "Unconditional Surrender: The Fall of Fort Donelson," *Tennessee Historical Quarterly*, XXI (March-June, 1962), 47-65, 140-61; Peter F. Walker, "Command Failure: The Fall of Forts Henry and Donelson," *Tennessee Historical Quarterly*, XVI (December, 1957), 335-60.

[8]A. S. Johnston to Judah P. Benjamin, February 8 and 25, 1862, *O.R.*, VII, 426-27, 863-64; Nichols, *Confederate Engineers*, p. 48.

[9]A. Schoopf to George E. Flynt, December 23, 1861, *O. R.*, VII, p. 514; F. K. Zollicoffer to W. W. Mackall, December, 9, 1861, *ibid.*, p. 11; John A. McClernand to U. S. Grant, February 10, 1862, *ibid*, pp. 126-30; Amos A. Fries, "Maj. Gen. James Birdseye McPherson," *Professional Memoirs*, VII (May-June, 1915), 378-82. Captain Frederick Prime was later exchanged and returned to Tennessee to take charge of military construction at Memphis; he was breveted three times before the end of the war; *Register of Graduates, USMA*, p. 199. General Felix Zollicoffer, in command of the Confederate right wing along the upper Cumberland River, also had engineer problems. The only Engineer officer in his command resigned, and General Zollicoffer wrote General Johnston: "Had I a military engineer, in whose judgment I could rely, to reconnoiter the mountain roads, gaps, and passes from Cumberland Gap to Jamestown, I would feel much more capable of making a judicious disposition of troops." See F. K. Zollicoffer to A. S. Johnston, September 19, 1861, *O.R.*, IV, 199; F. K. Zollicoffer to J. P. Benjamin, September 29, 1861, *ibid.*, p. 432; F. K. Zollicoffer to W. W. Mackall, October 29, 1861, *ibid.*, p. 487.

[10]John Fitch, *Annals of the Army of the Cumberland* (Philadelphia, 1864), pp. 192-98 (cited hereinafter as Fitch, *Annals*).

[11]Jesse A. Remington, "Combat Engineers: Lavergne, Tennessee, 1863," *Military Engineer*, LII (July-August, 1960), 291; Fitch, *Annals*, pp. 195, 411-12; William D. Bickham, *Rosecrans' Campaign with the Fourteenth Army Corps* (Cincinnati, 1863), pp. 300-02 (cited hereinafter as Bickham, *Rosecrans' Campaign*).

[12]Fitch, *Annals*, pp. 186-91; Bichham, *Rosecrans' Campaign*, pp. 81-82.

[13]J. B. Fry to James St. Clair Morton, July 8, 1862, *O.R.*, XVI, Pt. 2, 105-06; D. C. Buell to James St. Clair Morton, August 5, 1862, *ibid.*, p. 264; W. S. Smith to J. B. Fry, July 27, 1862, *ibid.*, p. 218.

[14]Thomas Van Horne, *History of the Army of the Cumberland: Its Organization, Campaigns, and Battles* (2 vols. and atlas; Cincinnati, 1875), II, 439-58, prints a long discussion of blockhouses and other matters by Captain W. E. Merrill. Detailed plans for blockhouses drawn by Captain Merrill and staff are in George P. Buell Papers, Manuscript Division, Tennessee State Library and Archives, Nashville, Tennessee.

[15]Van Horne, *History of the Army of the Cumberland: Its Organization, Campaigns, and Battles*, II, 439-58.

[16]*Ibid.*; U. S., Congress, House, *Message from the President of the Unitted States to the Two Houses of Congress*, H. Exec. Doc. No. 1, 39 Cong., 1 Sess., 1865, p. 977.

[17]Van Horne, *History of the Army of the Cumberland: Its Organization, Campaigns, and Battles*, II, 456-58.

[18]*Ibid.*; W. S. Rosecrans to Lorenzo Thomas, July 24, 1863, *O.R.*, XXIII, Pt. 1, 409.

[19]Testimony of James St. Clair Morton before McCook Court of Inquiry, February 13, 1864, *ibid.*, XXX, Pt. 1, 949-50; C. A. Dana to E. M. Stanton, September 22, 1863, *ibid.*, p. 196.

[20]U. S. Grant, "Chattanooga," in Vol. II of *Battles and Leaders of the Civil War* (4 vols., New York, 1888), ed. by Robert U. Johnson and Clarence C. Buel, pp. 685-89; William F Smith, "Comments on General Grant's 'Chattanooga,'" *ibid.*, pp. 714-17; W. F. Smith, "Report of operations at Brown's Ferry, October 26-28, 1863," *O.R.*, XXXI, Pt. 1, 77-78. General Morton clashed with General Rosecrans and requested the transfer. General William B. Hazen, who fought beside Morton and the Pioneer Brigade at Stone's River, speculated that Morton's death resulted from the clash with Rosecrans; he believed Morton needlessly took extraordinary risks in the campaign before Richmond to prove his abilities. See William B. Hazen, *A Narrative of Military Service* (Boston, 1885), p. 408. General William Farrar "Baldy" Smith was a crusty Vermonter, whose career was marked by a number of conflicts with other officers. James H. Wilson, *Life and Services of William Farrar Smith, Major General, United States Volunteers in the Civil War* (Wilmington, Del., 1904), is a fine biography by a friend and fellow Engineer officer.

[21]W. F. Smith, "Report of operations at Brown's Ferry, October 26-28, 1863, *O.R.*, XXXI, Pt. 1, 77-78; Jesse A. Remington, "Combat Engineers: The Brown's Ferry 'Cracker Line,' 1863," *Military Engineer*, LV (January-February, 1963), 22-23.

[22]Orlando M. Poe, *Personal Recollections of the Occupation of East Tennesee and the Defense of Knoxville* (reprint of 1889 edition; Knoxville, 1963), *passim*; Report of Captain Orlando M. Poe, Chief Engineer, Department of Ohio, January 13, 1864, *O.R.*, XXXI, Pt. 1, 294-97.

[23]Report of James Longstreet, January 1 and 10, 1864, *O.R.*, XXXI, Pt. 1, 455-56; Wilma Dykeman, *The French Broad* (New York, 1955), pp. 104-106; C. A. Dana to E. M. Stanton, December 6, 1863, *O.R.*, XXXI, Pt. 1, 263.

[24]Report of Lafayette McLaws, April 19, 1864, *O. R., XXXI, Pt. 1, 488-91*; (Betsy Creekmore, *Knoxville* (Knoxville, 1958), pp. 97-105; Harold S. Fink, "The East Tennessee Campaign and the Battle of Knoxville in 1863," East Tennessee Historical Society *Publications*, No. 29 (1957), 79-117.

[25]Fitch, *Annals*; pp. 651-52, 664-65; James St. Clair Morton to J. B. Fry, August 13, 1862, *O.R.*, XVI, Pt. 2, 326-27.

[26]Zealous Tower to Richard Delafield, October 10, 1864, *O.R.*, XXXIX, Pt. 3, 192-98; "Narrative from General Tower's reports of February 1 and March 31, 1865, to General Delafield," *O.R.*, Series II, V, 196-98.

[27]"Narrative from General Tower's reports of February 1 and March 31, 1865, to General Delafield," *O.R.*, Series II, V, 196-98.

[28]John B. Hood, "The Invasion of Tennessee," in Vol. IV of *Battles and Leaders of the Civil War*, pp. 435-36; W. W. Harts, "The Battle of Nashville," *Professional Memoirs*, VII (March-April, 1915), 191-203; Stanley Horn, *The Decisive Battle of Nashville* (Baton Rouge, 1956), *passim*.

[29]A. P. Mason to A. P. Stewart, December 24, 1864, *O. R.*, XLV, Pt. 2, 729; J. B. Hood to J. A. Seddon, December 25, 1864, *ibid.*, p. 731; W. D. Gale to E. C. Walthall, *ibid.*, pp. 741-42.
[30]Thomas Thatcher Graves, "The Occupation," in Vol. IV: *Battles and Leaders of the Civil War*, pp. 726-28.

CHAPTER 6: REGULATION OF THE TWIN RIVERS

[1]U. S., Congress, House, *Message from the President of the United States to the Two Houses of Congress*, H. Exec. Doc. No. 1, 39 Cong., 2 Sess., 1866, pp. 1-2, 6, 18; *River and Harbor Laws*, I, 152.
[2]Holt, *OCE*, p. 11; Frank E. Smith, *The Politics of Conservation* (New York, 1966), pp. 78-79; Pross, "Rivers and Harbors Appropriation Bills," pp. 43-89.
[3]*River and Harbor Laws*, I, 151-56; Smith, *The Politics of Conservation*, pp. 71-72.
[4]U. S., Congress, House, *Report of the Chief of Engineers*, H. Exec. Doc. No. 18, 39 Cong., 2 Sess., 1866, p. 4.
[5]Victor S. Clark, *History of Manufactures in the United States, 1860-1914* (Washington, 1928), p. 68; Samuel C. Williams, *General John T. Wilder, Commander of the Lightning Brigade* (Bloomington, 1936), pp. 40-46; Davidson, *The Tennessee*, II, 152-53.
[6]Clark, *History of Manufactures in the United States, 1860-1914*, pp. 212-17; Davidson, *The Tennessee*, II, 153-54.
[7]Davidson, *The Tennessee*, II, 156-60; TVA, *Tennessee River Navigation*, p. 18; United States, War Department, Corps of Engineers, *Annual Report of the Chief of Engineers for 1879* (Washington, 1880), p. 1248. The *Annual Report of Chief of Engineers* is the most important source for the history of the Corps of Engineers. Prior to 1867 the annual reports were printed in various government documents, usually accompanying the President's annual message to Congress, and are conveniently collected in the *American State Papers*. In 1867 the *Annual Report of the Chief of Engineers* was separately printed and bound and the series has since continued. Published annually at the end of the fiscal year (currently after a time lag of eighteen to twenty-four months), the title and format of the series has varied slightly from time to time, but is commonly known as the *Annual Report of the Chief of Engineers*. Hereinafter, it will be cited as *ARCE* followed by the fiscal year upon which the report was made. The use of *ibidem* might be a source of confusion when citing this series and will be dispensed with in this case, and, though the annual publication is multivolume, pages are numbered consecutively in each annual report until the 1953 edition; therefore, volume numbers will not be given until annual reports subsequent to 1953 are cited.
[8]*ARCE, 1879*, p. 1248.
[9]Govan and Livingood, *Chattanooga Country*, pp. 290-91; U. S. Congress, Senate, *Memorial of Citizens of Tennessee for Appropriations for Improvement of Tennessee River*, S. Misc. Doc. No. 2, 40 Cong., 3 Sess., 1868, *passim*.
[10]Chattanooga *Daily Republican*, July 19, 1868.
[11]Govan and Livingood, *Chattanooga Country*, pp. 291-92, 329; Harold Kelso, "Inland Waterway Policy in the United States" (unpublished Ph. D. dissertation, University of Wisconsin, 1942), p. 7n.
[12]David E. Donley, "The Flood of March, 1867, in the Tennessee River," East Tennessee Historical Society's *Publications*, No. 8 (1936), 54-73.
[13]*Ibid.* Donley's crest heights do not correspond with those calculated by the Army Engineers who estimate a height of 44.4 feet at Knoxville (flood stage: 12 feet) and 57.7 feet at Chattanooga (flood stage: 33 feet); see U. S., Congress, House, *Partial Survey of the Tennessee River and Its Tributaries*, H. Doc. No. 185, 70 Cong., 1 Sess., 1928, p. 11.
[14]*River and Harbor Laws*, I, 165.
[15]*Register of Graduates, USMA*, p. 203; George T. Ness, Jr., "Army Engineers of the Civil War," *Military Engineer*, LVII (January-February, 1965), 38-40; *Dictionary of American Biography*, X, 616-17; *ARCE, 1867*, pp. 38-39.
[16]*ARCE, 1868*, p. 557; Colonel Gaw's personal dossier is inclosed in W. B. Stokes to J. M. Schofield, July 28, 1868, "Letters Received, 1865-70," NA, RG 77; see also Godfrey Weitzel to A. A. Humphreys, August 4, 1868, March 7 and 9, 1870, *ibid.*
[17]Godfrey Weitzel to A. A. Humphreys, August 4, 1868, March 7 and 9, 1870, "Letters Received, 1865-70," NA, RG 77; *O.R.*, XXX, Pt. 3, 84-85, 409; Trowbridge, *The South: A Tour of Its Battlefields and Ruined Cities*, pp. 253-54, describes Colonel Gaw's 16th U. S. Infantry (Colored) at Chattanooga.
[18]*ARCE, 1868*, pp. 559-89.
[19]*ARCE, 1868*, pp. 559-89; Chattanooga *Daily Republican*, October 8 and 9, 1968.
[20]*ARCE, 1868*, p. 582.
[21]*ARCE, 1868*, p. 587.
[22]*ARCE, 1868*, p. 558.
[23]*ARCE, 1868*, pp. 558-59.
[24]*River and Harbor Laws*, I, 173; Godfrey Weitzel to A. A. Humphreys, August 4, 1868, "Letters Received, 1865-70," NA, RG 77; *ARCE, 1869*, p. 285.
[25]*ARCE, 1869*, pp. 279-81; Godfrey Weitzel to A. A. Humphreys, March 7 and 9, 1870, "Letters Received, 1865-70," NA, RG 77.
[26]William Harris to W. B. Stokes, March 17, 1870, "Letters Received, 1865-70," NA, RG 77; *ARCE, 1871*, p. 491. Milton Butler Adams graduated from West Point in 1865; he later returned to Nashville as District Engineer in 1900, and retired from the service in 1909 with the rank of Colonel. *Register of Graduates. USMA*, p. 211.
[27]*River and Harbor Laws*, I, 185; Nashville *Republican Banner*, July 28, 1870.
[28]Douglas, *Steamboatin'*, p. 195: Trowbridge, *The South, A Tour of Its Battlefields and Ruined Cities*, pp. 279-80; *ARCE, 1871*, p. 485.
[29]Douglas, *Steamboatin'*, pp. 196-99; *ARCE, 1881*, pp. 1894-96.
[30]Clark, *History of Manufactures in the United States, 1860-1914*, pp. 65, 205; Eddyville *Herald Ledger*, May 28, 1970 (William Kelly Memorial Edition); *ARCE, 1871*, p. 484; Douglas, *Steamboatin'*, pp. 195-96.
[31]*ARCE, 1871*, p. 473, 481-84; Lewis Collins and Richard Collins, *History of Kentucky* (2nd ed., rev.; Louisville, 1877), p. 144; Douglas, *Steamboatin'*, pp. 279-80.
[32]Douglas, *Steamboatin'*, pp. 241-42, 278-79; Nashville *Tennessean*, May 12, 1957; *ARCE, 1875*, pp. 795-800; *ARCE, 1879*, p. 1268.
[33]Godfrey Weitzel to A. A. Humphrey, July 29, 1870, "Letters Received, 1865-1870," NA, RG 77; *ARCE*, 1871, p. 468; "Sylvanus Thayer Abert, M. ASCE," *Transactions of the American Society of Civil Engineers*, LIX (1907), 521-30.
[34]*ARCE, 1871*, pp. 463-85.
[35]*River and Harbor Laws*, I, 194, 196; *ARCE, 1871*, pp. 467-68; *ARCE, 1873*, pp. 543-53.

[36]Holt, *OCE*, p. 13, 24-25; *ARCE, 1872*, pp. 478-79, records Major Walter McFarland's opinion of contractors; *ARCE, 1880*, p. 1670, quotes Major W. R. King's equally acid opinion. Contractors were not always completely at fault; Major Walter McFarland annulled the contract of J. H. Dennis of Louisville, Ky., in 1872, because after three contract extensions work still remained incompleted; nevertheless, Dennis brought suit for the forfeited percentage of his contract fee and won. See *ARCE, 1872*, p. 59, and *ARCE, 1874*, p. 576.

[37]Samuel A. Weakley, private interview with employee, Nashville District, 1911-1949, July 22, 1970.

[38]*ARCE, 1874*, pp. 809-17; *ARCE, 1876*, p. 722.

[39]*ARCE, 1887*, pp. 1773-79; *ARCE, 1893*, p. 2336; Holston River Navigability Report, Waterways Management Branch, Operations Division, Nashville Engineer District.

[40]John L. Van Ornum, The Regulation of Rivers (New York, 1914), pp. 100-01; John L. Van Ornum, "Work of the Third Regiment, U.S. Volunteer Engineers in Cuba," *Engineering News*, XLI (June 22, 1899), 400-01; E. O. Sweetzer and Luther E. Smith, "John Lane Van Ornum, M. ASCE," *Transactions of the American Society of Civil Engineers*, CXI (1946), 1559-63.

[41]*ARCE, 1893*, pp. 2338-39; *Dictionary of American Biography*, VII, 617-18.

[42]*ARCE, 1880*, p. 1721. Nor were morale and morals of District personnel neglected: camp regulations for survey parties in 1915 read: "men in each tent will keep it and its vicinity clean and free from trash. Beds will be made up before breakfast. Blankets and bedding will be aired Sunday mornings. . . . Lights will go out by 9:30 p.m., and no noise will be allowed in camp after that hour. Any man coming on the work under the influence of liquor or bringing liquor into camp will be suspended, regardless of his position or importance to the party. Men are requested to bring all complaints as to food before the chief of party. No comments as to quality of food will be permitted at the table. . . ." U.S., Congress, House, *Report on Preliminary Examination and Survey of Tennessee River between Browns Island and the Railroad Bridge below the City of Florence*. H. Doc. No. 1262, 64 Cong., 1 Sess., 1916, pp. 67-68.

[43]*ARCE, 1880*, p. 1695.

[44]*ARCE, 1881*, pp. 1280-82, 1854; Frederic Molitor, "Samuel Whinery, M. ASCE," *Transactions of the American Society of Civil Engineers*, LXXXIX (1926), 1701-05.

[45]*ARCE, 1898*, pp. 1946-47.

[46]*ARCE, 1876*, p. 711; *ARCE, 1896*, p. 1932.

[47]*ARCE, 1914*, p. 2566.

[48]*ARCE, 1876*, p. 711; *ARCE, 1896*, p. 1927.

[49]*ARCE, 1885*, pp. 198-207, 273-79; Harold C. Fiske to Chief of Engineers, February 10, 1926, "Correspondence Relating to Rivers and Harbors, 1923-42," NA, RG 77.

[50]Mary L. Granger, *History of the Savannah District* (Savannah, 1968), p. 15; Roy Scheufele, *History of the North Pacific Division, U. S. Army, Corps of Engineers, 1888-1965* (Portland, Ore., 1969), p. 1; *ARCE, 1889*, p. 16; Henry L. Abbot, "Cyrus Ballou Comstock," *Professional Memoirs*, VIII (March-April, 1916), 218-22.

[51]Pross, "Rivers and Harbors Appropriation Bills," p. 71; Wilma Dykeman, *The French Broad* (New York, 1955), pp. 17-19.

[52]Holt, *OCE*, pp. 20-21.

[53]Emory R. Johnson, *Inland Waterways, Their Relation to Transportation* (supplement to the *Annals of the American Academy of Political and Social Science*; Philadelphia, 1893), p. 119; *ARCE, 1881*, p. 1840; *ARCE, 1884*, p. 1648.

[54]*ARCE, 1893*, pp. 2327-29; *ARCE, 1894*, p. 273; *ARCE, 1895*, p. 2246; *ARCE, 1900*, p. 2889.

[55]*ARCE, 1891*, p. 2263, quoting Captain J. E. Newman of the steamboat *Lucille Borden*.

[56]*ARCE, 1883*, p. 1496; *ARCE, 1900*, p. 3073; *ARCE, 1923*, pp. 1191-99.

CHAPTER 7: CANALS ON THE TENNESSEE

[1]Ambler, *Transportation in the Ohio Valley*, pp. 405-06; Lytle Brown, "Federal River and Harbor Policies," *Civil-Engineering*, V (August, 1935), 460.

[2]U. S., Congress, Senate, *Report of the Select Committee on Transportation-Routes to the Seaboard*, S. Rept. No. 307, 43 Cong., 1 Sess., 1874, I, 71-78.

[3]*ARCE, 1872*, pp. 509-51; *Augusta* [*Ga.*] *Herald*, July 23, 1969.

[4]*ARCE, 1879*, pp. 1393-1421, prints the Kentucky-Cumberland Canal survey report; Tennessee, State Commission on Improvement to Waterways, *Report of the State Commission on Improvement to Waterways, Showing the Results of Surveys of the Proposed Tennessee and Mississippi River Canal. Together with the Chief Engineer's Estimates of Its Tonnage, Revenue and Income, and Cost of Construction* (Jackson, Tennessee, 1893), is a report of survey by the State of a canal route; *ARCE, 1875*, pp. 803-09, prints a survey of the Tennessee-Tombigbee route.

[5]The Atlantic and Great Western Canal Company was chartered by Georgia in 1869; it requested, but did not receive, aid of the United States in construction of the proposed canal. See U. S., Congress, Senate, *Report of the Select Committee on Transportation-Routes to the Seaboard*, S. Rept. No. 307, 43 Cong., 1 Sess., 1874, II, 745. *ARCE, 1872*, pp. 509-51, prints a survey of the proposed canal route.

[6]*ARCE, 1872*, pp. 509-51; U. S., Congress, Senate, *Report of the Select Committee on Transportation-Routes to the Seaboard*, S. Rept. No. 307, 43 Cong., 1 Sess., 1874, II, 756-73.

[7]*River and Harbor Laws*, I, 326; *ARCE, 1881*, pp. 1890-94.

[8]U. S., Congress, Senate, *Report of the Select Committee on Transportation-Routes to the Seaboard*, S. Rept. No. 307, 43 Cong., 1 Sess., 1874, 183-87, 249; see also statement by Walter S. Winn in Campbell, *Upper Tennessee*, p. 136.

[9]*ARCE, 1868*, p. 589; W. B. Stokes, Thomas J. Carlise, and N. J. Parrish to Edwin Stanton, July 12, 1867, "Letters Received, 1865-70," NA, RG 77.

[10]*Register of Graduates, USMA*, p. 207; Wilson, *Under the Old Flag*, I, 21-22.

[11]*ARCE, 1872*, pp. 495-501. In 1907 a survey party was so debilitated by disease that only four men were left of the original party at the end of the field work and one young man who began as rodman ended as chief of party. U. S., Congress, House, *Report on Preliminary Examination and Survey of Tennessee River between Browns Island and the Railroad Bridge below the City of Florence*, H. Doc. No. 1262, 64 Cong., 1 Sess., 1916, p. 69.

[12]*ARCE, 1872*, pp. 476-501; Leftwich, *Two Hundred Years at Muscle Shoals*, pp. 234-35.

[13]*ARCE, 1874*, p. 570; Chattanooga *Daily Times*, January 14, 1874.

[14]*ARCE, 1890*, p. 2115; *ARCE, 1879*, p. 1250;

ARCE, 1880, pp. 184, 1670; *ARCE, 1875*, pp. 786-88.

[15]*ARCE, 1874*, pp. 571-74; *ARCE, 1884*, p. 1642; A convention assembled in Chattanooga in 1877 to urge speedy prosecution of the Muscle Shoals project, and the delegates pointed out the relation of the project to the proposed "Atlantic and Great Western Canal." "The Improvement of the Tennessee River," *Engineering News*, IV (December, 1877), 336.

[16]*ARCE, 1876*, p. 86; Phillip Thienel, "The Longest Floating Bridge," *Military Engineer*, XLIX (March-April, 1957), 120; *Register of Graduates, USMA*, p. 210.

[17]*ARCE, 1879*, pp. 1251-52.

[18]*ARCE, 1883*, pp. 1479-80.

[19]*ARCE, 1877*, pp. 581-82, describes General Marshall's invention as a "modified form of drop-gate; *Register of Graduates, USMA*, p. 214; *Dictionary of American Biography*, VI, 332-33; Charles Keller, "Death of General Marshall," *Military Engineer*, XII (September-October, 1920), 438.

[20]*ARCE, 1881*, pp. 1847-48; Samuel A. Weakley, "Jesse James' Brothers Activities in the Nashville District," (unpublished 2 page typescript, NDHF); much correspondence concerning the robbery is located in "Letters Received, Office Chief of Engineers, 1881," NA, RG 77, and "Letters Received, Secretary of War, 1881-82," Old Military Records Division, NA; Chattanooga *Daily Times*, March 15 and 31, 1881; Chattanooga *Evening News*, April 16-26, 1884 (see also recent article in Nashville *Tennessean*, February 28, 1971); U. S. vs. Dick Liddel, alias Dick Little (Criminal Case No. 2710), and U.S. vs. Frank James (Criminal Case No. 3063), Northern District of Alabama, Huntsville, Ala., Legislative, Judicial and Diplomatic Records Section, NA; authoritative on the activities of the James gang is William A. Settle, Jr., *Jesse James Was His Name or, Fact and Fiction Concerning the Careers of the Notorious James Brothers of Missouri* (Columbia, Mo., 1966), see especially pp. 54, 107-08, 110, 113-14, 129-33, 137-53; Carl W. Breihan, *The Day Jesse James Was Killed* (New York: 1962), provides a vivid account of activities of the James brothers.

[21]From 1886 to 1890 construction of the canal was under general direction of Colonel John W. Barlow, first Nashville District Engineer, whose activities in the District are discussed more fully in the following chapter. Lieutenant Goethals reported to Colonel Barlow in 1889 and was assigned to the Muscle Shoals project. The interview with General Sherman is related in Joseph B. Bishop and Farnham Bishop, *Goethals, Genius of the Panama Canal: A Biography* (New York, 1930), pp. 51-52 (cited hereinafter as Bishop and Bishop, *Goethals*).

[22]*Ibid.*, pp. 63-70; Chattanooga *Evening News*, November 10-14, 1890.

[23]Govan and Livingood, *Chattanooga Country*, pp. 362-64; Davidson, *The Tennessee*, II, 169; U. S., Congress, House, *Survey of the Tennessee River*, H. Doc. No. 360, 62 Cong., 2 Sess., 1910, 191-92, prints testimony of J. N. Trigg, Vice President of the Chattanooga Packet Company.

[24]*ARCE, 1891*, p. 278; *ARCE, 1895*, pp. 2277-78; *ARCE, 1894*, pp. 1829-30; *ARCE, 1896*, pp. 2038-46; *ARCE, 1897*, pp. 2304-05; *ARCE, 1907*, p. 1643.

[25]*ARCE, 1895*, pp. 304, 310; *Register of Graduates, USMA*, p. 223; T. A. Bingham to Thomas L. Casey, April 5, 1895, "General Correspondence, 1894-1823," NA, RG 77.

[26]George R. Goethals, "Sydney Bacon Williamson, M. ASCE," *Transactions of the American Society of Civil Engineers*, CV (1940), 1943; Bishop and Bishop, *Goethals*, pp. 64-66; Thomas M. Robins to George R. Goethals, December 8, 1928, "Correspondence Relating to Rivers and Harbors, 1923-42," NA, RG 77.

[27]Bishop and Bishop, *Goethals*, pp. 66-67.

[28]*Ibid.*, pp. 67-69; Goethals, "Sydney Bacon Williamson, M. ASCE," *Transactions of the American Society of Civil Engineers*, CV (1940), 1940-54.

[29]*Ibid.*; Bishop and Bishop, *Goethals*, pp. 204-07.

[30]Bishop and Bishop, *Goethals*, pp. 69, 72; Joseph Wheeler to Thomas L. Casey, October 2, 1894, "General Correspondence, 1894-1823," NA, RG 77.

[31]Campbell, *Upper Tennessee*, p. 98.

[32]*ARCE, 1897*, pp. 2261-62; *ARCE, 1899*, pp. 2268-69; *ARCE, 1895*, p. 2294; *ARCE, 1908*, p. 1708; *ARCE,1903*, p. 1596. For full discussion of construction of Colbert Shoals Canal see U. S., Congress, House, *Report on the Preliminary Examination and a Partial Survey of Tennessee River and Tributaries*, H. Doc. No. 319, 67 Cong., 2 Sess., 1922, pp. 31-32, and Harry Burgess, "The Colbert Shoals Canal, Tennessee River, Alabama," *Professional Memoirs*, V (November-December, 1913), 613-49, and VI (January-February, 1914), 69-101.

[33]Complete traffic statistics are given in Tables of Traffic Nos. 7 and 8 in U. S., Congress, House, *Report on Preliminary Examination and a Partial Survey of Tennessee River and Tributaries*, H. Doc. No. 319, 67 Cong., 2 Sess., 1922, p. 26.

CHAPTER 8: CANALIZATION OF THE CUMBERLAND

[1]*River and Harbor Laws*, I, 194, 205, 215; *ARCE, 1873*, p. 61.

[2]*ARCE, 1874*, pp. 577-79; *Nashville City Directory, 1874* (Nashville, 1874), p. 210.

[3]*Nashville City Directory, 1880* (Nashville, 1880), p. 373; *Nashville City Directory, 1882* (Nashville, 1882), p. 21.

[4]Klein, ed., *Ohio River Handbook*, p. 371.

[5]*River and Harbor Laws*, I, 355, 389; Cumberland River Commission, *Report of Cumberland River Commission for 1903 to Hon. James B. Frazier, Governor* (pamphlet; Nashville, 1903), pp. 4-5; *ARCE, 1884*, pp. 1663-75.

[6]*ARCE, 1885*, pp. 1760-61.

[7]U. S., Congress, House, Rivers and Harbors Committee, *Report of the Board of Engineers for Rivers and Harbors on Cumberland River above Nashville, Tenn.*, R. & H. Comm. Doc. No. 10, 63 Cong., 2 Sess., 1914, pp. 98-99; *ARCE, 1882*, pp. 1845-46, 1865-68; *ARCE, 1887*, pp. 1762-64.

[8]*ARCE, 1892*, pp. 1937-38; *River and Harbor Laws*, II, 1101-03; *ARCE, 1905*, p. 451; Thomas E. Murray, "Improvement of the Tennessee River and Power Installation of the Chattanooga and Tennessee River Power Company at Hale's Bar, Tennessee," *Transactions of the American Society of Mechanical Engineers*, XXVII (1906), 545-46.

[9]*ARCE, 1886*, p. 264; *Dictionary of American Biography*, I, 613; *Register of Graduates, USMA*, p. 208.

[10]Hunter McDonald, Wilbur F. Foster, and E. C. Lewis, "Charles Abbott Locke, M. ASCE," *Transactions of the American Society of Civil Engineers*, LXXX (1916), 2186-87.

[11]*ARCE, 1887*, p. 1760; *ARCE, 1888*, pp. 1622-26.

[12]George R. Bethurum, Jr., private interview, August 6, 1969.

[13]Indorsement of Chief of Engineers, General Thomas L. Casey, dated October 3, 1894, on Chattanooga Chamber of Commerce to Secretary of War, September 27, 1894, "General Correspondence, 1894-1823," NA, RG 77; copy of Special Orders, No. 191, August 18, 1888, NDHF; Nashville *Banner*, August 24, 1888; Chattanooga *Daily Times*, August 23, 1888.

[14]Nashville *Daily American*, September 30, 1888, October 4 and 7, 1888; S. H. Hassall, "History of the Nashville Engineer District and Its Development of the Cumberland River" (unpublished typewritten manuscript, NDHF), *passim;* Samuel A. Weakley, "History of Nashville District as Recounted by S. A. Weakley" (unpublished typewritten manuscript, NDHF), *passim*.

[15]Nashville *Daily American*, October 7, 1888; Emmett H. Bullock to G. R. Bethurum, Jr., March 7, 1970, NDHF; Herbert Deakyne to Secretary of War, May 11, 1927, "Correspondence Relating to Rivers and Harbors, 1923-42," NA, RG 77; Nashville District, *Lifeline*, XII (November, 1944), 13; Clinton B. Sears, "A Remarkable Testimonial to the Work of Civil Engineers," *Engineering News*, LXIII (February 10, 1910), 171.

[16]Nashville *Daily American*, September 20, 1888; Cumberland River Improvement Association, *The Cumberland River: The Need of Building Locks and Dams along Its Entire Course without Delay Emphasized* (pamphlet; Nashville, 1891), pp. 7, 20-21.

[17]*River and Harbor Laws*, I, 505-527; Douglas, *Steamboatin'*, pp. 223-34.

[18]*ARCE, 1890*, pp. 2153-54, 2156-61; *River and Harbor Laws*, I, 633.

[19]*Register of Graduates, USMA*, p. 205; Henry M. Robert, *Robert's Rules of Order Revised* (Chicago, 1951), p. 13.

[20]Bishop and Bishop, *Goethals*, pp. 70-71.

[21]Jennie Wright to Henry M. Robert, February 4, 1896, Henry Martyn Robert Papers, Manuscript Division, Library of Congress; Joseph Wheeler to Henry M. Robert, August 23, 1986, *ibid.*

[22]*ARCE, 1894*, p. 1805.

[23]S. H. Hassall, "History of the Nashville Engineer District and Its Development of the Cumberland River," *passim;* J. R. Slattery, "Crib Dams on the Cumberland River," *Military Engineer*, XV (September-October, 1923), 420-21.

[24]W. W. Harts, "Cumberland River Canalization," *Engineering Record*, LXI (April 16, 1910), 512-14.

[25]*ARCE, 1873*, pp. 548-53; Hunter McDonald, "John Simpson Walker, M. ASCE," *Transactions of the American Society of Civil Engineers*, XCVI (1932), 1576-77.

[26]McDonald, *ibid.;* Emmett H. Bullock to G. R. Bethurum, Jr., March 7, 1970, NDHF; see editorial note in *Professional Memoirs*, III (October-December, 1911), 687-88, and IV (May-June, 1912), 438-39.

[27]Samuel A. Weakley and John O. Hicks, employees, Nashville District, private interview, August 6, 1969; John Biddle to Henry M. Robert, January 27, 1894, Henry Martyn Robert Papers, Manuscript Division, Library of Congress; *ARCE, 1915*, p. 1085; *ARCE, 1920*, pp. 2576-77; *ARCE, 1921*, p. 1280; John S. Butler, "Notes on the Construction of Locks B, C, and D, Cumberland River," *Professional Memoirs*, VIII (May-June, 1916), 365-82.

[28]*ARCE, 1888*, p. 1620.

[29]Wilbur F. Creighton, Sr., "Construction from a Contractor's View Point" (unpublished typewritten manuscript, W. F. Creighton, Jr., Nashville), p. 56.

[30]*Ibid.*, p. 8.

[31]*Ibid.*, pp. 8, 109, 114; John S. Butler, "Notes on the Construction of Locks B, C, and D, Cumberland River," *Professional Memoirs*, VIII (May-June, 1916), 366-67.

[32]Gilbert M. Dorland to Lewis A. Pick, August 12, 1954, TLO Files, ND.

[33]*Register of Graduates, USMA*, p. 225; Susan Dayton Copland, "John Biddle, M. ASCE," *Transactions of the American Society of Civil Engineers*, CII (1937), 1501-08; *ARCE, 1901*, pp. 58-61; Wilson, *Under the Old Flag*, II, 417, 422.

[34]*ARCE, 1898*, pp. 330, 339; *ARCE, 1888*, pp. 394, 401.

[35]Douglas, *Steamboatin'*, pp. 233-36; Wilbur F. Creighton, Sr., *Building of Nashville* (Nashville, 1969), pp. 28-29; *Nashville Banner*, August 18, 1969.

[36]Leahy, *Who's Who on the Ohio River*, p. 383; Clark, *History of Manufactures in the United States, 1860-1914*, pp. 774, 777-78.

[37]*ARCE, 1901*, p. 2409; *ARCE, 1902*, pp. 1696, 1704; M. B. Adams to Cumberland River Committee, Retail Merchants' Association of Nashville, April 8, 1902, "General Correspondence, 1894-1923," NA, RG 77; M. B. Adams to George L. Gillespie, April 11, 1902, *ibid.*

[38]Cumberland River Commission, *Report of the Cumberland River Commission for 1903 to Hon. James B. Frazier, Governor*, pp. 16-17; Retail Merchants' Association of Nashville to George L. Gillespie, June 11, 1902, "General Correspondence, 1894-1923," NA, RG 77; "Transcript of Proceedings before Board of Engineers of Rivers and Harbors Committee at Nashville Board of Trade, February 2nd, 1906," Manuscript Section, Tennessee State Library and Archives, Nashville, Tennessee; *ARCE, 1906*, p. 495.

[39]*ARCE, 1905*, p. 451; *ARCE, 1908*, p. 556; U. S., Congress, House, *Project for Improvement of Cumberland River*, H. Doc. No. 699, 59 Cong., 1 Sess., 1906, *passim;* John S. Butler, "Costs of Forms at Lock No. 21, Cumberland River," *Professional Memoirs*, III (October-December, 1911), 602.

[40]James O'Sullivan, "John Soule Butler, M. ASCE," *Transactions of the American Society of Civil Engineers*, CXI (1946), 1443-48; Emmett H. Bullock to G. R. Bethurum, Jr., March 7, 1970, NDHF; Smith, *Politics of Conservation*, pp. 260-61; Samuel A. Weakley, private interview, July 22, 1970.

[41]Emmett H. Bullock to G. R. Bethurum, Jr., March 7, 1970, NDHF; Samuel A. Weakley, private interview, July 22, 1970; *Register of Graduates, USMA*, p. 233.

[42]U. S., Congress, House, *Preliminary Report of Survey of Lower Cumberland River for Locks and Dams*, H. Doc. No. 758, 60 Cong., 1 Sess., 1908, p. 6; *ARCE, 1909*, pp. 1682-83; *River and Harbor Laws*, II, 1409; *ARCE, 1911*, pp. 715, 2030.

[43]U. S., Congress, House, Rivers and Harbors Committee, *Report of the Board of Engineers for Rivers and Harbors on Cumberland River above Nashville, Tenn.*, R. & H. Comm. Doc. No. 10, 63 Cong., 2 Sess., 1914, pp. 113-24.

[44]*Ibid.*, pp. 44-45, 124-39.

[45]*Ibid.*, pp. 1-8; *River and Harbor Laws*, III, 1776; Leahy, *Who's Who on the Ohio River*, p. 671; *ARCE, 1921*, p. 1287.

[46]Douglas, *Steamboatin'*, pp. 222, 269-70; U. S., Congress, House, *Report on Survey of Tennessee River from Confluence of the Holston and French Broad to Its Mouth*, H. Doc. No. 360, 62 Cong., 2 Sess., 1910, p. 25; *ARCE, 1922*, p. 1302.

[47]Leahy, *Who's Who on the Ohio River*, pp. 666-68; Douglas, *Steamboatin'*, pp. 254, 259-63; Ramey, "History of Pulaski County," p. 122.

[48]Ambler, *Transportation in the Ohio Valley*, pp. 356-68; C. McD. Townsend, "Decline of Water Transportation on Western Rivers," *Professional Memoirs*, II (January-March, 1910), 20-29; "Public Expenditures for Inland Waterway Improvements," *Engineering News*, LXI (May 6, 1909), 498; Pross, "Rivers and Harbors Appropriation Bills," p. 238.

[49]Harold Fiske to Chief of Engineers, July 3, 1923, "Correspondence Relating to Rivers and Harbors," NA, RG 77.

CHAPTER 9: WHERE THE NIGHTS ARE ILLUMINATED

[1]Edison is quoted in Tennessee River Improvement Association, *A Visit to the Tennessee River on the Invitation of the Tennessee River Improvement Association by the Secretary of War, etc. . . .* (pamphlet; Birmingham, 1915), n. p.

[2]Dyer, *Wheeler*, pp. 302, 352-53; Smith, *Politics of Conservation*, pp. 101-02; Judson King, "The Legislative History of Muscle Shoals." (Confidential First Draft; Knoxville, 1936, NDHF), pp. 1-3.

[3]*ARCE, 1900*, pp. 2058-61; Govan and Livingood, *Chattanooga Country*, p. 445; *ARCE, 1904*, pp. 445, 2361.

[4]*ARCE, 1904*, pp. 445, 2361; *ARCE, 1905*, p. 1739; *ARCE, 1906*, pp. 1518-19; Thomas E. Murray, "Improvement of the Tennessee River and Power Installation of the Chattanooga and Tennessee River Power Company at Hales' Bar, Tennessee," *Transactions of the American Society of Mechanical Engineers*, XXVII (1906), 521-51.

[5]*ARCE, 1905*, pp. 1739-40; E. H. Marks to Chief of Engineers, January 24, 1941, "Correspondence Relating to Rivers and Harbors," NA, RG 77; U. S. Congress, House, *Survey of Tennessee River from Confluence of the Holston and French Broad to Its Mouth*, H. Doc. No. 360, 62 Cong., 2 Sess., 1910, pp. 27-28.

[6]Harold C. Fiske to Chief of Engineers, December 10, 1925, "Correspondence Relating to Rivers and Harbors," NA, RG 77; "Progress on the Tennessee River Power Development," *Engineering Record*, LXIII (June 10, 1911), 643.

[7]Harold C. Fiske to Chief of Engineers, December 10, 1925, "Correspondence Relating to Rivers and Harbors," NA, RG 77.

[8]Chamber of Commerce, Chattanooga, J. P Winn, Secretary, to John A. Moon, August 8, 1911, "General Correspondence, 1894-1923," NA, RG 77, is a sample of the petitions; Chief of Engineers to R. W. Austin, August 19, 1911, *ibid.*; *Register of Graduates, USMA*, p. 251; Edward Burr to Director, Chattanooga and Tennessee River Power Company, March 29, 1913, "General Correspondence, 1894-1923," NA, RG 77. Captain Rose later served as Director of Purchases for the United States Army during World War I and was recalled in 1941 to direct construction of mammoth aircraft assembly plants the Engineers built for the Air Force; see Eugene Reybold, "Engineers in World War II," *Military Engineer*, XXXVIII (January, 1946), 25.

[9]Edward Burr to Director, Chattanooga and Tennessee River Power Company, March 29, 1913, "General Correspondence, 1894-1923," NA, RG 77; Edward Burr to Nashville District Engineer, April 11, 1913, *ibid.*; Harry Burgess to Chief of Engineers, April 14, 1913, *ibid.*; Lindley Garrision to C. E. James, September 29, 1913, *ibid.* Richard Curtis Moore served as commander of 318th Engineers, A. E. F., in 1917; Deputy Chief of Staff, War Department, 1940-42; and served in 1945 with the Joint Chiefs of Staff. He died at Monterey, California, August 20, 1966; see *Register of Graduates, USMA*, p. 251.

[10]Accounts of the dam's dimensions vary considerably; see *ARCE, 1915*, p. 1113, and Charles A. McMurry, *Chattanooga: Its History and Geography* (Morristown, Tenn., 1923), pp. 293-94. *ARCE, 1914*, pp. 994-95, 1006-07.

[11]E. H. Marks to Chief of Engineers, January 24, 1941, "Correspondence Relating to Rivers and Harbors," NA, RG 77; E. L. Madere and Roger B. McWhorter, "Caisson Work at Hales Bar Dam," *Professional Memoirs*, V (January-February, 1913), 78-82.

[12]McMurry, *Chattanooga: Its History and Geography*, pp. 296-97; *ARCE, 1914*, p. 2562.

[13]*ARCE, 1914*, p. 2562; Madere and McWhorter, "Caisson Work at Hales Bar Dam," *Professional Memoirs*, V. (January-February, 1913), 78-82; E. H. Marks to Chief of Engineers, January 24, 1941, "Correspondence Relating to Rivers and Harbors," NA, RG 77; Harold C. Fiske to Chief of Engineers, December 10, 1925, *ibid.*; Samuel A. Weakley, private interview, July 7, 1970.

[14]Amos A. Fries, "The Failure of the Austin Dam," *Professional Memoirs*, IV (January-February, 1912), 108-11; McMurry, *Chattanooga: Its History and Geography*, p. 296; "Rock Grouting and Caisson Sinking for the Hales Bar Dam," *Engineering News*, LXX (November 13, 1913), 949-56; Charles H. Tisdale, "Treatment of the Foundation for the Power House and Dam, Hales Bar, Tennessee River," *Professional Memoirs*, IV (January-February, 1912), 36-45.

[15]Edward B. Burwell, Jr., Senior Geologist, report on Hales Bar leaks to Division Engineer, ORD, January 21, 1941, appended to E. H. Marks to Chief of Engineers, January 24, 1941, "Corspondence Relating to Rivers and Harbors," NA, RG 77.

[16]*Chattnooga News-Free Press*, March 4, 1965; TVA, *Tennessee River Navigation*, p. 23.

[17]U. S., Congress, House, *Report of Board of Engineers on Re-examination of the Report on Survey of Muscle Shoals*, H. Doc. No. 14, 60 Cong., 2 Sess., 1909, p. 20.

[18]Judson King, *The Conservation Fight from Theodore Roosevelt to the Tennessee Valley Authority* (Washington, 1959), pp. 36-39; *Register of Graduates, USMA*, p. 240; Lytle Brown, "Harry Burgess, M. ASCE," *Transactions of the American Society of Civil Engineers*, XCVIII (1933), 1511-13; U. S., Congress, House, *Report on Preliminary Examination and Survey of Tennessee River between Brown's Island and the Railroad Bridge below the City of Florence*, H. Doc. No. 1262, 64 Cong., 1 Sess., 1916, *passim*. The manuscript of this report is in Nashville District Library, labeled Harry Burgess, "Preliminary Report of Muscle Shoals." Burgess's comments quoted from pp. 11-12 of the manuscript.

[19]King, "The Legislative History of Muscle Shoals," pp. 28-29; Burgess, "Preliminary Report of Muscle Shoals," pp. 144-45; U. S., Congress, House, *Report on Preliminary Examination and Survey of Tennessee River between Brown's Island and the Railroad Bridge below the City of Florence*, H. Doc. No. 1262, 64 Cong., 1 Sess., 1916, pp. 1-5; Comments in April 1976 by G. O. Prados, Asst. Chief, Engineering Div. and Chief, Design Branch, Nashville District.

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CHAPTER 12: COMPREHENSIVE CRESCENDO

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B. Materials in Engineer Office, Nashville District, Corps of Engineers:

This collection is massive in volume, but scattered throughout the Office building in filing cabinets and cardboard containers with minimal organization, except for general comments inscribed on the exterior of the containers which sometimes indicates their contents. Most records which relate to the history of the District prior to 1945 have been retired to the National Archives and subsidiary Federal Records Centers, but a few remain in the District Office files along with more recent materials. The District Office files of historical interest have been classified by the author in four general divisions:

1. Engineering Data File, which contains the Old Map Collection with maps dating back to 1830 and a collection of thousands of photo-

graphs taken as early as 1877 of Engineer operations in the twin valleys.

2. Nashville District Library, which contains most congressional documents relating to Engineer operations on the Cumberland and Tennessee rivers since 1900, the *Annual Report of the Chief of of Engineers*, many professional engineering journals, technical reports, and published works relating to the history of water resource development and the history of the twin valleys.

3. Nashville District Historical File (NDHF), which contains a collection of correspondence, orders, memoirs and questionaires collected from retired employees, and many other miscellaneous items.

4. Technical Liaison Office Files (TLO Files, ND), which contain an extensive collection of newspaper clippings, organized by year or project, manuscripts of speeches and formal papers written by Engineer officers and District personnel, public relations materials, and many other miscellaneous items.

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C. Materials Relating to the History of the Nashville District in the National Archives:

Records relating to the history of the operations of the United States Army Engineers on the Cumberland and Tennessee rivers are found in Records of the Office of the Chief of Engineers, Record Group 77, National Archives (NA, RG 77), a voluminous collection, but convenient access to these materials is provided by an unpublished preliminary inventory: General Services Administration. National Archives and Records Service. The National Archives. "Preliminary Inventory of the Textual Records of the Office of the Chief of Engineers (Record Group 77)." 2 parts and supplements. Compiled by Elizabeth Bethel and Maizie H. Johnson. The items in this collection most relevant to the history of the Nashville District are at three locations: the oldest District records are at Federal Records Center, East Point, Georgia; the records of the Office of the Chief of Engineers and the Topographical Bureau prior to 1923 in the Old Military Records Section, National Archives, Washington, D. C.; and the more recent records, since 1923, of the Office of the Chief of Engineers at Federal Records Center, Suitland, Maryland. The materials in the collection of most historical interest are:

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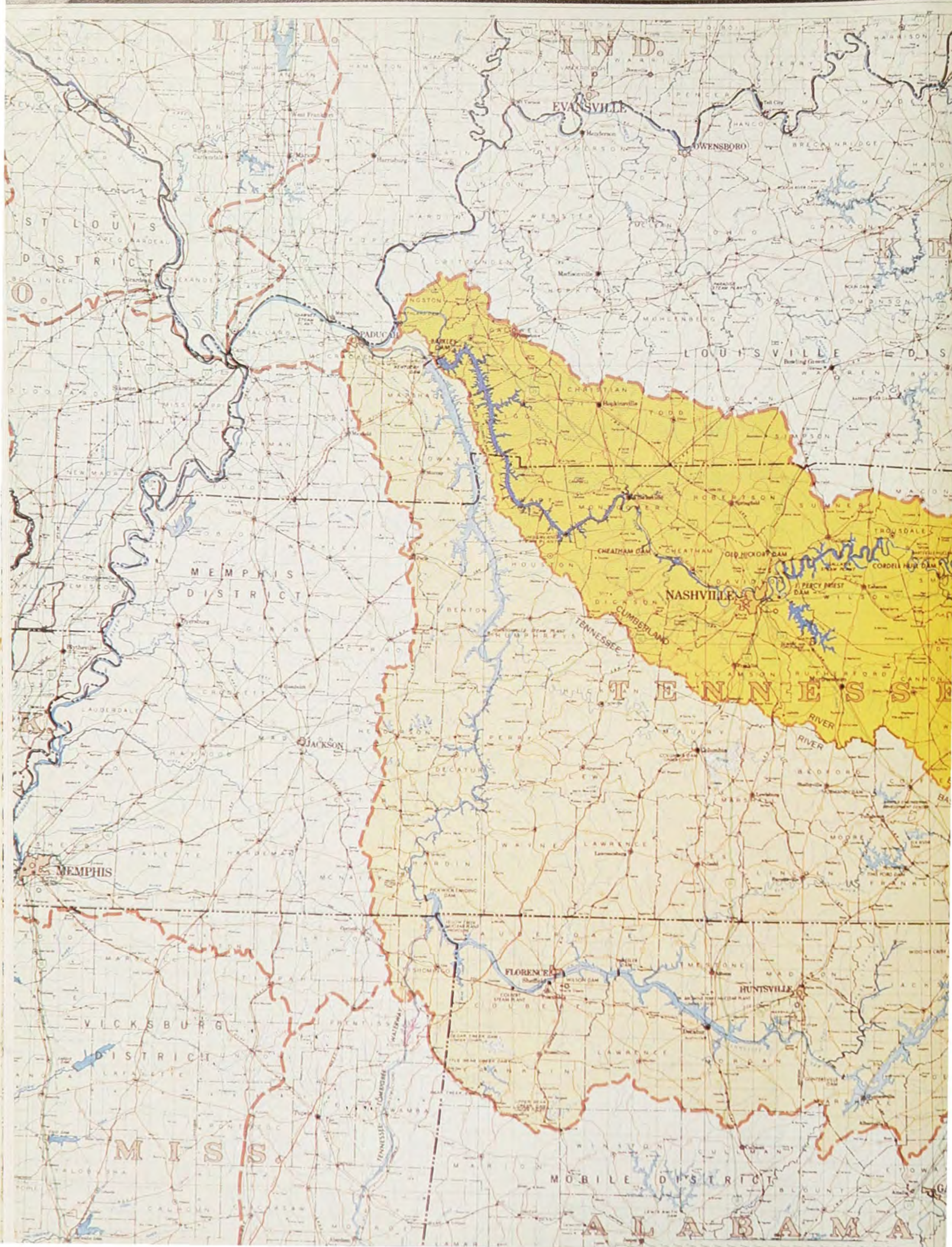
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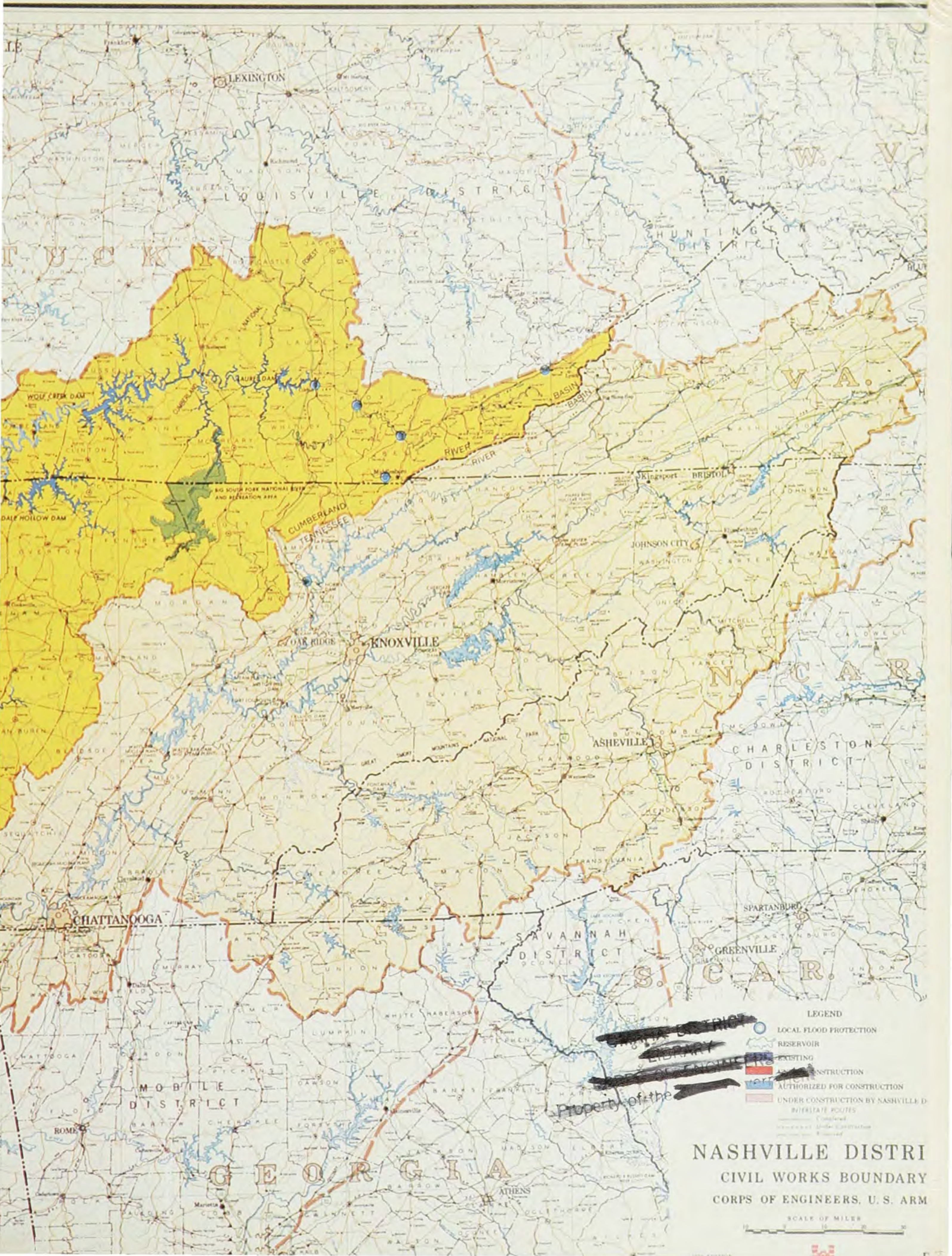

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